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AN ILLUSTRATED REVIEW OF PROGRESS IN ELECTRIC AND OTHER TRACTION

**Established in 1892.**

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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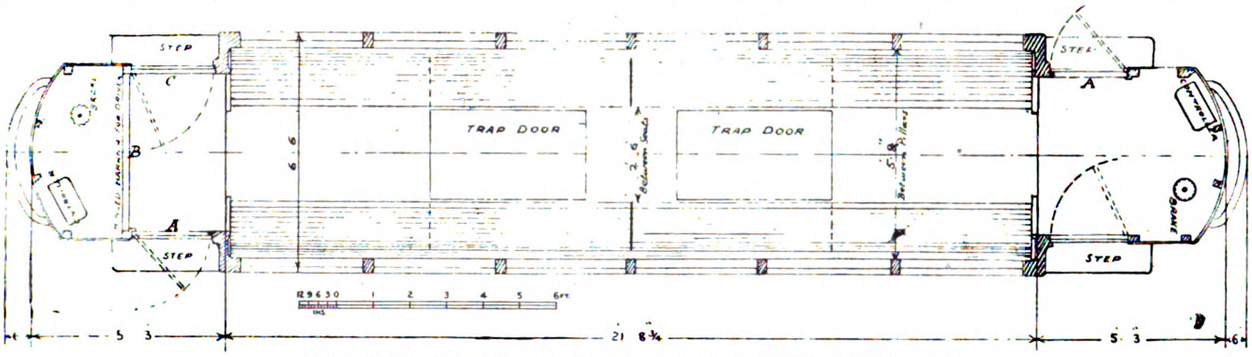
# NEW TYPE OF SINGLE-DECK CAR.

A car presenting a number of novel features of a most practical character has recently been designed and constructed in the Tividale Works of the Birmingham and Midland Tramways Joint Committee by Mr. R. Humphries, tramway engineer to the committee. The gauge of the Black Country Tramways is only 3 ft. 6 in., and experience has shown that the racking stresses of double-deck cars, especially when they are top-covered cars, on this gauge, are very severe. This is especially the case on single track with loops, as it will be readily recognised that the frequent and continual swerving of the car in motion tends to dismember it. The higher the centre of gravity of the car, the more severe and detrimental these stresses become.

Single-Deck Car—Birmingham and Midland Tramways.

The accompanying view and plan shows the main points of the Tividale car. The objects in view have been (*a*) light superstructure, (*b*) absence of all unnecessary doors and partitions, and (*c*) maximum carrying capacity (both normal and overload) for a minimum weight and cost. The car body proper is 21 ft. 9 in. long, with longitudinal seating for 17 on each side. The platforms are 5 ft. 3 in. in length, thus making the total length of car 32 ft. 3 in. This is considered to be the maximum length desirable on two axles, the truck wheel base being 8 ft. 6 in.




Plan of Single-Deck Car—Birmingham and Midland Tramways.

To come to the actual novelties in design and construction, first among these is the absence of bulkhead doors. It will be seen that as soon as passengers mount the platform they are in the car, and do not have to wend their way through other doors. This gives a decidedly Pullman effect to the inside of the car, and adds wonderfully to its roominess. In the opinion of the designer, the bulkhead is a relic of the old open-fronted platform. In these days, when the platform staff insist on covered fronts, the days of the bulkhead are numbered. The complete vestibule gives shelter in all weathers and seasons to both staff and passengers, and the overload capacity is quite

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100 per cent., still leaving space for the conductress to carry out her duties. The protection afforded to both driver and conductress should enable them in the winter to carry out their work without swathing themselves up from head to foot in wrappings not conducive either to good driving or good conducting.

The near side front exit enables traffic to be handled expeditiously, and separates outgoing from incoming passengers. This also has the benefit of inducing passengers to file up to the front end of the car, thus filling the vehicle and distributing the load. The door of the exit "A" is under the control of the driver, and is not released until the car is brought to a stand. This door opens outwards, and automatically closes after the passenger leaves the step. The opening of the door is a danger signal to approaching traffic, and will at once draw attention to the dismounting passenger. An additional safeguard at night time is given in the shape of a lamp placed right over the step, so that the alighting passenger is visible at all times.

The hinged barrier "B" behind the driver is made to fasten the off-side door so that a passenger cannot open this door and alight on the "devil strip." The same remark holds good when the door "A" is on the off-side; it is then locked against use, and a seat for the conductress is fitted beside it. This seat on the reversal of direction of the car is taken to the opposite end, and the driver's barrier folds up against the sidepillar.

The vision of the driver for night work is guarded against reflected light by means of a roller blind which drops behind him on to the top of the barrier "B." The door "C," when on the rear end, is made to fold back against the inside of the vestibule, thus giving a very roomy platform. In very cold weather this door can, of course, be closed, and the vehicle will then be weather-tight.

The ventilation of the car has been proved by practical experience to be excellent in all sorts and conditions of weather. Ventilation is carried out by a row of torpedo-catchers over the side windows, and a hinged window on the left hand of the driver gives additional ventilation when required.

The car has been very well received by the public; its current consumption is extremely low, and its acceleration high, and it is as highly thought of by the traffic staff as it is by the engineering staff.

The engineering and electrical details of this car are as follows:—The controllers are fitted with a rheostatic brake attachment, and the trolley-tapping is in parallel through an automatic switch at both ends of the car. Advantage has been taken of the covered platform to run the cables on the top instead of underneath the platform, so that these are not exposed as in standard practice to the accumulated mud and wet underneath the platform. The axles are equipped with gear centres hydraulically pressed on instead of keyed. This has been standard practice for a number of years on the Black Country Tramways with most satisfactory results. The gear rim is renewable, and bolted on in two halves. The motors fitted are G.E. 58, 4-turn, giving 37·5 H.P. each, so that the equipment is fit for all the grades found in the Black Country. Finally, the absence of the monitor roof enables the car to operate on routes that pass under low railway bridges. The car is finished in a severely plain style throughout, and great attention has been paid to the avoidance of all dust-traps and inaccessible receptacles for used tickets, etc. Not the least of the merits of the design is that it can be cleaned out with a minimum of labour in a minimum of time.

The car was inspected by Lieut.-Col. Druitt, of the Board of Trade, on June 21, and passed for general service, and at the request of the Birmingham Corporation immediately commenced to run on the Black Country through service into Colmore Row, Birmingham.

## SOME VITAL FACTORS IN TRAMWAY OPERATION.

By DAVID MCCOLL
*(General Manager, Shanghai Tramways).*

In your issue of February 17 I have read, with unusual interest, the article headed "Halfpenny Fares on Tramways," by "A Special Correspondent." With his contention as to the importance of the rate per mile of each fare I agree. Considered in this way, the ½d. fare in London is much dearer per mile than the 1d. fare. In Glasgow the ½d. fare, the average distance for which is now 1·15 miles, is at the same rate per mile as the 1d. fare. Formerly in Glasgow the ½d. fare was at more than double the rate per mile of the 1d. fare.

The considerations advanced by your correspondent regarding the advantages of ½d. fares, under suitable conditions, state principles which my experience has taught me are sound. His remarks, however, regarding the highest average load per car attainable on the London County Council Tramways, and also as to the fixity of costs per car-mile, are less easy to accept. Dealing with the first of these two points, he lays it down that "On the London County Council Tramways the average load of a car at any point on the highest possible reckoning is only 23 passengers, even in these days of overcrowding." As your correspondent has used this average of 23 in conjunction with what he reckons to be the necessary average fare which should have been charged per mile in order to yield the car-mile earnings of 13·14d., which he indicates were required to enable the London County Council Tramways to meet all contingencies for that year, it is bound to be on the basis of average distance paid for, not average distance actually travelled—two somewhat different things. If the figure of 23 passengers per car (in other words, 23 passenger miles paid for per car-mile) is correct, it means that, as practically all the London County Council cars are seated, I understand, for 74, your correspondent considers that, if 31 per cent. of the seating accommodation provided is paid for, the best possible average is attained. This 23, divided by 11·39 (passengers per car-mile, 1915-16), gives 2·02 miles as the average distance paid for—which seems rather high in view of the enormous volume of traffic at very short distances and of the more convenient facilities provided by the railways for the longer distance traffic. However, as the average receipt per passenger for 1915-16 was 1·03d., this figure, divided by the deduced figure of 2·02 miles, gives 0·51d. as the average receipt per passenger-mile paid for. Twenty-three multiplied by 0·51d. gives 11·73d., the actual car-mile earnings for 1915-16. But the reliability of these derived figures of average distance paid for and average receipt per passenger-mile paid for depends, of course, upon the accuracy of your correspondent's figure of 23 passengers per car. I have no data as to the average distance at each fare and the number of passengers at each fare for the London County Council Tramways to enable me to work out the actual passengers per car (or passenger-miles paid for per car-mile). But your correspondent gives, for the Glasgow tramways, the figure "28 passengers per car," which, with cars seated for 62, means that slightly over 45 per cent. of the seating accommodation

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provided was paid for. To test this, I have worked out the actual Glasgow figure for 1915-16 as follows :—

| Fare. | Average Distance (Miles) | Passengers (Millions). | Passenger Miles Paid for (Millions). |
|---|---|---|---|
| ½d.... | 1·15 | 233 | 267·95 |
| 1d.... | 2·31 | 94 | 217·14 |
| 1½d. | 3·46 | 22 | 76·12 |
| 2d.... | 4·62 | 7 | 32·34 |
| 2½d. | 5·75 | 3 | 17·25 |
| 3d. and over | 6·50 (say) | 3 | 19·50 |
| | | 362 | 630·30 |

| Passenger Miles Paid for (Millions). | | Passengers (Millions). | | |
|---|---|---|---|---|
| 630·30 | ÷ | 362 | = | 1·74 miles paid for per passenger. |

| Average Fare per Passenger. | | Miles Paid for per passenger (as above). | | Average Receipt per Passenger Mile paid for. |
|---|---|---|---|---|
| Then 0·761d. | ÷ | 1·74 | = | 0·44d. |

The figure of 0·44d. brought out above as the average receipt per passenger-mile paid for agrees with the figure for the average fare charged per mile, as given in the Glasgow Annual Report for 1915-16. Naturally this would be so, as all the Glasgow fares (contrary to what is the case in some other cities) are at the same rate per mile. The figure of 1·74 brought out as the miles paid for per passenger is thus proved, and puts beyond doubt the percentage of seating accommodation paid for in Glasgow, because all that remains is to multiply 1·74 by 14·516 (passengers per car-mile), which gives 25·26 as the passenger-miles paid for per car-mile (termed "passengers per car" by your correspondent) instead of 28 as stated by him. This 25·26 is equal to 40·74 per cent. of the seating accommodation, as compared with 31 per cent. suggested by your correspondent as the London figure. But, as he has overstated the Glasgow figure, it is possible he may also have overstated the London figure, which may actually be less than 31 per cent.

The average distance actually travelled is obviously, however, on all undertakings less than the average distance paid for, and the former is the effective factor to be used in considering whether the average occupancy is adequate or not. This point can readily be illustrated from the Glasgow figures ; when the distance there for the halfpenny fare was half-a-mile, there were nearly 70 million halfpenny passengers per annum, and doubtless most of these still travel only half-a-mile. Then many millions more who pay ½d. (the total at that fare for 1915-16 was 233 millions) probably travel different distances between half-a-mile and the average ½d. average of 1·15 miles. Similarly, although an average distance of 2·31 miles is given for 1d., millions of 1d. passengers are bound to travel different distances between 2·31 miles and something not much beyond the ½d. distance of 1·15 miles.

The same principle applies to the higher fares, although the ratio of average distance untravelled to average distance given at each of the higher fares diminishes as the fare increases. It is evident, after making such allowances, the average distance actually travelled in Glasgow for 1915-16 is unlikely to have exceeded 1·4 miles. Therefore 14·615 passengers per car-mile (1915-16) × 1·4 miles, assumed as the average travelled per passenger = 20·32 passenger-miles per car-mile (or with cars seated for 62, an occupancy of 32·77 per cent.).

Although the occupancy of the Glasgow cars is probably as high as that of any undertaking in the United Kingdom (and, apparently, higher than most), it does not appear from the above calculations to be more than one-third (very much less than that of the former horse-cars) ; and it is not, I think, claimed by the management that this occupancy is incapable of being raised without increase of standing passengers and without causing inconvenience to the public.

It is clear that the ratio of seating accommodation paid for to seating accommodation provided is distinctly lower for the London Council Tramways than for the Glasgow undertaking, and it does seem that this factor is capable of improvement in London (without increase of standing passengers and without inconvenience to the public) to such an extent as to yield at least the higher car-mile earnings stipulated by your correspondent. It is to be noted that a good beginning in improved occupancy of the London County Council cars has already been made in 1915-16 over the previous year, as the following comparison shows :—

| | 1915-16. | 1914-15. |
|---|---|---|
| Passengers per car-mile | 11·39 | 9·33 |
| Revenue per car-mile | 11·73d. | 9·77d. |

As a result of this higher occupancy, the financial results of 1915-16 (after eliminating increased war service allowances) were improved by nearly £94,000, as compared with 1914-15. That there is still some distance to go in this direction (still without inconvenience to the public) is suggested by (*a*) the appreciably higher ratio of occupancy of the Glasgow electric cars (as already shown), and (*b*) the very much higher ratio of occupancy of horse-cars (figures as to which are given later). May I add that my own experience of operating electric cars leads towards the same conclusion.

As most people concerned in tramway working are aware, horse-cars in the United Kingdom, although they had only about one-half the seating accommodation of the electric cars which superseded them, carried practically as many passengers per car-mile, notwithstanding the fact that against the number of passengers in the horse-cars being at any time appreciably in excess of the seating accommodation there were obvious considerations which do not apply to electric cars. The percentage of the seating accommodation generally paid for in electric tramcars in the United Kingdom is apparently little more than half the percentage of the accommodation formerly paid for in horse-cars. I have not beside me the necessary figures for the London County Council Tramways to enable me to give comparisons of the occupancy of horse and electric cars respectively for that undertaking over a range of years, but in this connection I have extracted data from the last annual report of the Glasgow Corporation Tramways. The Glasgow undertaking for practically the first eight years was worked by horse traction ; for that period the average number of passengers per car-mile was 12·7. For the next 14 years, under electric traction, the much larger cars carried only 12·1 passengers per car-mile.

There does not appear to be any material difference in the average distance paid for in electric cars as compared with horse-cars. The horse-cars therefore, carrying slightly more passengers per car-mile with so very much less seating accommodation than the electric cars, showed over-all a much higher ratio of accommodation paid for to accommodation provided. These results are, I suppose, approximately representative of what has happened generally in the cities of the United Kingdom. What is the explanation ? Since the days of horse traction most of the tramway systems in the United Kingdom have been greatly extended, and a considerable proportion of the additional track traverses much less densely populated districts than the track of the horse traction period. The relatively low ratio of occupancy of electric cars is probably due, to a considerable extent, to the service run on such extensions being unduly disproportionate to the traffic available, and also perhaps to the extent to which

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there are practically empty return trips of "rush" hour cars required for single journeys in one direction only. I do not venture to criticise municipal policy as regards the frequency of services given at places and times of scanty traffic, especially when the undertaking as a whole is profitable; but it is important to avoid confusing (as your correspondent seems to have done) the actual ratio of accommodation paid for to accommodation provided with the conveniently possible ratio on the basis of routes, time tables, etc., planned to minimise waste car-mileage. In addition to the question of adjustment of routes and time tables so as to avoid possible over-service on outlying lines, there is, as already suggested, that of eliminating, as far as practicable, empty or almost empty return trips of cars required only for single-trip, one-direction "rush" traffic. Cars stored during slack hours near where the "in" rush finishes would be certain to be ready where wanted for the next "out" rush, and vice-versa, because the "in" and "out" rushes regularly alternate.

Your correspondent declares that the London County Council Tramways required to earn 13·14d. per car-mile for 1915-16 in order to meet all contingencies, instead of only 11·73d. actually earned. Without the benefits of general trailer car working (to which I shall refer later), the undertaking does appear to have required such earnings. Although the receipts per mile of route were £15,600, as compared with only £11,571 for Glasgow, the capital expenditure per mile of route is about two-and-a-half times that of the Glasgow undertaking, and this necessitates substantially higher car-mile earnings in addition to much higher earnings per mile of route. Assuming, however, that your correspondent is correct in stating that 31 per cent. of the seating accommodation provided on the London County Council cars was paid for in 1915-16 (the meaning of his figure of 23 average passengers per car), if 40·74 per cent. of the seating accommodation had been paid for, as in Glasgow, the total receipts per car-mile would have been 15·41d. with the present fares. If only 34·72 per cent. of the seating accommodation had been paid for (well under the Glasgow figure), your correspondent's stipulated total receipts per car-mile of 13·14d. would have been realised with the present fares. This means that on the average only two and two-thirds more of the 74 seats would have had to be paid for than your correspondent suggests was done. (These car-mile figures are, of course, subject to slight correction due to the fact that when car mileage is reduced all items of expenditure are not reduced *pro rata*, just as also, when car-mileage is increased, all items of expenditure are not increased *pro rata*.)

For the Shanghai tramways the ratio of seating accommodation paid for to seating accommodation provided was over 60 per cent. last year. Owing to the cars being of different types and capacities, this figure has to be arrived at on a seat-mile basis. This high ratio is explained partly by a steady all-day traffic having been cultivated on most routes, the conditions being more favourable for this than they are in the cities of the United Kingdom, and partly to studied adjustment of routes and services to traffic requirements, according to time and place. To show that the high ratio of 60 per cent. is not due to a starved service, it is worth mentioning that the Shanghai number of passengers carried per mile of route is even higher than the high total of the London County Council Tramways. It is not suggested that anything approaching 60 per cent. is attainable in the United Kingdom, but this experience is mentioned to give point to the suggestion of the possibility of something like 35 per cent. being conveniently reached and maintained in London, with the important result of placing the finances of the London County Council undertaking on an indisputably sound basis.

Your correspondent appears to have assumed the present occupancy as a fixity incapable of increase, and that therefore, as higher car-mile earnings are required, they can only be obtained by means of higher fares. Logically, the doubling (practically) of the seating accommodation per car, due to the introduction of electric traction, should permit of an appreciable addition to the average load per car.

The two factors of rate of fare and occupancy are really mutually dependent; the rate of fare may or may not be such as to produce the volume requisite for adequate occupancy, whilst the occupancy of the cars which is reasonably possible, having regard to their accommodation, influences the rate of fare which can be charged. Of the two factors that of occupancy seems at present, for such an undertaking as the London County Council Tramways, to possess the greater possibilities. It would be unwise, however, to attempt to lay down any arbitrary figures as generally attainable because conditions are so dissimilar in different places; actual experiments with both factors are usually the best means of arriving at the most suitable arrangements.

With regard to the inclusive cost per car-mile which, also, your correspondent is inclined to assume as a fixity for the London County Council Tramways, I submit that, in view of the contemplated extensive development of trailer working by that undertaking and of the very low capital and working costs of trailer cars as compared with motor cars, the inclusive cost per car-mile should certainly be capable of substantial reduction below the 1915-16 figure. Your correspondent suggests that the London County Council fares require to be increased if the necessary car-mile earnings are to be obtained. Before this can be accepted, he must prove that the present ratio of accommodation paid for to accommodation provided cannot be conveniently increased. It must also be taken into account that to increase fares might be to restrict the volume of traffic, and thus interfere with trailer development, which is so important to the future of the London County Council undertaking.

A concrete example of the advantages of trailer working is afforded by the experience of the Shanghai Tramways: for 1910 our ratio of trailer car-miles to motor car-miles was only 5 per cent. (trailers were only then being introduced); for 1916 this ratio had risen to 60 per cent. (although the motor car-miles per mile of route had been substantially increased), causing working expenses per car-mile (total mileage) to fall by 23 per cent. in the same years. Moreover, there had been considerable economy in capital expenditure by the general employment of trailers. It is perhaps worth adding that the receipts per trailer car-mile are practically the same as the receipts per motor car-mile, and that receipts per car-mile (total mileage) for 1916 were 10 per cent. higher than for 1910.

I have written this article in no spirit of mere controversy—it is my first communication to THE TRAMWAY AND RAILWAY WORLD, although I have been connected with traction in different forms for over twenty years—but because the whole problem suggested by your correspondent's article is one of the first importance, and because my long study and experience of that problem, in different cities and under different conditions, in the United Kingdom and abroad, have led me to conclusions which are perhaps of such interest and significance as to warrant their being put on record in your columns.

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## LONDON COUNTY COUNCIL TRAMWAY FARES.

By A. J. Lawson, M.Inst.C.E.

In the financial year which ended on March 31 last the total revenue of the London County Council's tramways from passenger fares (according to the reports presented at various meetings of the Council) was, in round figures, £2,460,000, or £181,000 more than in 1915-16. Assuming that the average fare per passenger remained the same as in the previous year, viz., 1·003d., the receipts represent about 589,000,000 passengers carried, or an increase of 43,000,000.

The adjusted final figures are to be presented to the Council on July 18, and no doubt will be worthy of study in detail. Whatever the final accounts may show, however, there can be no doubt that they will demonstrate, it is to be hoped even to the complete conviction of all parties on the Council, that the present fares—after allowing for the suspension of the ½d. fares and return tickets—are still altogether inadequate. Let it be borne in mind that each mile of single track tramway in London has cost £46,770 to construct and equip, and that of the total length of lines within the county 2½ miles are leased, leaving 141·67 route miles of double track to be worked by the Council itself, and that the average fare per passenger should not be less than 1·16d. to pay all working expenses and to meet the capital charges, depreciation, and renewals. To put the tramways on the same footing as the Glasgow tramways, having regard to the respective costs, the fare would require to average 1·22d. per passenger; but then Glasgow makes a profit on its tramways, which in a municipally-owned undertaking is no doubt pleasant to the Corporation, though it militates against such cheapening of fares as passengers may claim to be justly entitled to. But London's mismanagement of tramway finance, with inadequate fares and consequent failure to make provision for proper repairs, reconstruction, or renewals is a much worse mistake in the other direction.

The revenue of any undertaking run by a municipality should be so adjusted that after payment of all working expenses and capital charges there should be neither a profit nor a loss.

The Glasgow tramways in the financial year, which ended in May, carried 388,000,000 passengers at an average fare of ·77d. per passenger, which yielded an income of £1,245,000 on approximately 100 route miles of double track, the capital expenditure on which was only £19,370 per track mile, or 41·8 per cent. of the cost of the London lines. This number of passengers was 26,000,000 more than in 1915-16.

At a special meeting of the London County Council held on May 18, 1917, a recommendation of the Highways Committee to "suspend" halfpenny fares and return tickets was carried on a division, the party which prefers philanthropy at the expense of the ratepayers to the business management method of making the tramways pay their way being handsomely defeated. Workmen's tickets at rates that yield less than the cost of working the early morning cars which carry this traffic, and nothing at all towards capital charges, are still retained, though the addition of only ½d. per ticket per day would provide a very slight margin of profit. So also the transfer ticket, over which the Council is defrauded wholesale, is retained, and the proportioning of fares to length of stages remains to be dealt with, after calling in experts to advise the Council, which apparently does not rely upon the opinion of its own officers.

The Highway Committee was at pains to state:—"We are proposing suspension, not abolition, of the fare ratings referred to, as we have no wish to prejudge the question whether (or no) there should be a reversion to them on the resumption of normal conditions—including normal working costs." As normal working costs would probably mean a reversion to pre-war wages of the Council's employees, the reversion to halfpenny fares and return tickets is clearly adjourned *ad Kalendas Græcas.*

The members of the Council who took part in the debate were clearly at a loss to know why, with overloaded cars in the mornings and evenings, and taking all possible traffic, the receipts are insufficient; hence the need of outside expert advice. The Minister of Education might possibly suggest the right kind of expert. In the discussion the terms "30 per cent. of the passengers," "30 per cent. of the traffic," and "30 per cent. of the revenue" were all used, though what was probably intended was to convey the information that 30 per cent. of the total number of passengers travelled on the cars at halfpenny fares, or that 30 per cent. of the traffic yielded only 12 per cent. of the revenue. The management of the tramways was severely commented on, "badly managed," "deliberately mismanaged," and "grossly mismanaged" being among the terms used. If true, the reflection is on the Council, not on the officials or committees. If halfpenny fares were part of the original scheme, why was the very costly slot system adopted? Nobody now would care to have the overhead trolley system in central London; but with the adoption of the conduit system of construction the introduction or retention of halfpenny fares was a mistake. Estimates of cost, traffic, revenue, and fares surely must have been made and presented to the Council; or did the expenditure and the experience "just grow," the Council relying upon municipal ownership as a Providence to provide its daily bread?

"I 'spects so"—and twelve years' experience of tramway working apparently leaves the members with childlike faith that something will turn up to relieve them of the responsibility of deciding anything lest it should be made a "party question," except to increase the working expenses so as to absorb any increase in revenue. And so perhaps it is well that the latter should be underestimated, as it has been in the case of the possible result from the abolition of ½d. fares. Far better results than those foreseen in the estimates recently presented have already been obtained, but the increased costs, being based upon already agreed advances in pay to drivers and conductors, and in heavy salaries, will swallow up the greater part of the increased income, leaving the Council still far short of the means to put the tramways in good physical condition or on a firm financial foundation. This can only be done by raising fares all round, so that the average fare shall not be less than 1·16d. per passenger at least.

One member proposed that as the average fare was only 1·01d. (as he said), the Council should adopt a universal fare of 1d. only, so as to induce more traffic! I wonder if the Council will experiment on this line? *Quien sabe?*

A lady member—Miss Adler—made a plea for the retention of the halfpenny fare at midday to enable poor workgirls to get home to dinner and back in time for work. The use of 1d. return tickets might in such cases be beneficial both to workgirls and lads, and not lessen revenue; but the writer would suggest to Miss Adler and her colleagues who are interested in the welfare of young workpeople that the best way of helping them would be to promote and strive for legislation which will do away with the "sweating"

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of labour of this class, and provide for the payment of a living wage as well as of a margin over bare living expenses which will enable the youth of both sexes to afford even a penny fare for tramway rides to and from dinner at home. The payment of starvation wages to young girls and women especially is a disgrace to London, and mere eleemosynary help in the payment of part of the cost of their fares out of the pockets of other passengers, or even out of those of the ratepayers, neither benefits the recipients of such charity nor removes the stain from the city that permits the wrong. And don't turn all the central parts of the city and inner boroughs into offices, warehouses, and factories; keep some portions for workpeople and others to live and market in; then there will be no need for an hour's journey in the morning to work and another hour's journey or more to return from it. Some of London's outer suburbs are very nice places to live in; but taken all in all they are neither cheaper nor more healthy than central localities from which occasional visits to other districts can be more conveniently made.

The proper housing of the working classes does not necessarily imply the building by the County Council of workmen's dwellings at Tooting and the running of tramways at a loss to bring them to and fro at other people's expense. Luxury will give place to necessity within a measurable period, and the coming inevitable conscription of wealth or capital amassed from profiteering in food, or from very fat Government contracts in war time, will render the payment of fair wages to men and women workers essential and not too difficult of performance in that universal co-operative society in which every member of the community must have a proper share. In that condition of society there will be no room for cranks on the County Council or elsewhere who have attained notoriety—not fame as they fondly imagine—by treating workmen and workwomen as paupers to be provided with cheap rides on the tramcars, because they were not paid a fair wage for a fair day's work to enable them to pay their way out of their own pockets.

## THE LONDON POST OFFICE RAILWAY.

Some interesting information was given in the House of Commons on June 5 in regard to the progress of construction of the London Post Office Railway. Mr. Illingworth (Postmaster-General), in his annual review, made on the occasion of the presentation of a vote of £13,480,310 for the Post Office, said that the London Post Office Railway was a very useful scheme which was instituted by Mr. H. Samuel when Postmaster-General. The work on it had been continued slowly during the year. Some people had criticised the continuance of that work during the war, but he thought it would have been unwise to have discontinued it, as the contractors were committed to a very large expenditure. The course the Government had adopted would in the long run turn out to be the cheaper and better way. Only two small sections remained to be finished, one near Liverpool Street and the other between Mount Pleasant and the West Central Post Office. The laying of the permanent way and electrical equipment had been entirely suspended until the end of the war.

Sir C. Hobhouse asked for some information as to the cost of the railway, and said he was certain that when the railway was completed the release of Post Office vehicles from the streets of London would be quite remarkable. There would be a great saving of cost, and also a great convenience to the public. The railway would mean a revolution in the transport of letters throughout the London district.

Mr. Pease (Assistant Postmaster-General), in replying to the discussion, said that tenders for the construction of the tunnel were issued when Sir C. Hobhouse was Postmaster-General. The lowest was accepted, the figure being £668,421. The question of suspending the construction of the tunnel in order to discontinue capital expenditure under war conditions had been considered on several occasions, but the suspension would have considerably increased the outlay on construction in the long run. It was ascertained that the contractors were committed to an expenditure of about £350,000, and that a considerable amount of material had already been delivered or manufactured, or was in process of manufacture, for which payment would have to be made. He thought that the undertaking was likely to be a great success from every point of view. Construction had been much slowed down by shortage of labour and materials, but the work was now near completion. The expenditure on tunnelling up to April 1 was £547,454.

Mr. Illingworth, answering a question in the House of Commons on May 22, stated that at that time 435 men were employed on the tunnel construction. Twenty-five tons of steel and 14,000 tons of cast-iron segments had been used during the year ended March 31 last. By far the greater part of the iron was manufactured before that period, and practically all the steel before the outbreak of war.

## AMERICAN ELECTRIC RAILWAYS.

We have recently received the June issue of that eminently useful publication, the Electric Railway Section of the *Commercial and Financial Chronicle*, of New York. This supplement is issued three times a year, and the present number consists of 144 closely printed foolscap size pages, containing financial and other particulars relating to something approaching 2,000 electric railway companies in America, including Canada. Seventeen of the more important systems are illustrated by large scale maps showing all the routes, both urban and inter-urban. These maps can be read in conjunction with the information in the text under the heading of "Road," which gives the length of railway, places in which the lines are situated, types of rails used, number of cars employed, and so forth. The names of the officers are also given. The bulk of the lines are, of course, of the nature of tramways and inter-urban light railways. Perhaps two of the most interesting of the maps are those showing respectively the surface trolley lines and the rapid transit lines of the Brooklyn system. The extraordinary development of electric traction in the United States, when indicated in the way that this publication does, must lead the reader to think out afresh the reasons for such an expansion, the like of which can be found in no other country. The reasons are well enough known, but even those who know them may well marvel at the development attained.

**Electricity Bulk Supply.**—Mr. G. Roberts, Parliamentary Secretary to the Board of Trade, replying to a question by Mr. P. A. Harris in the House of Commons on June 21, stated that it was not a fact that the Departmental Committee on Electricity had prepared a report in favour of dividing the country into definite areas for the production of electricity.

**Car Lighting.**—Since the summer began tramways authorities of the Metropolis have been allowed to resume normal lighting of the covered top decks. The concession, which is greatly appreciated by the public, was granted on condition that the lighting circuits are so arranged that with the exception of the traffic lights the whole of the lighting can be switched off when an air raid warning is given. If one or more interior lights are kept on to complete the circuit, they must be kept shrouded, so that no light is visible from outside during the period of a warning.

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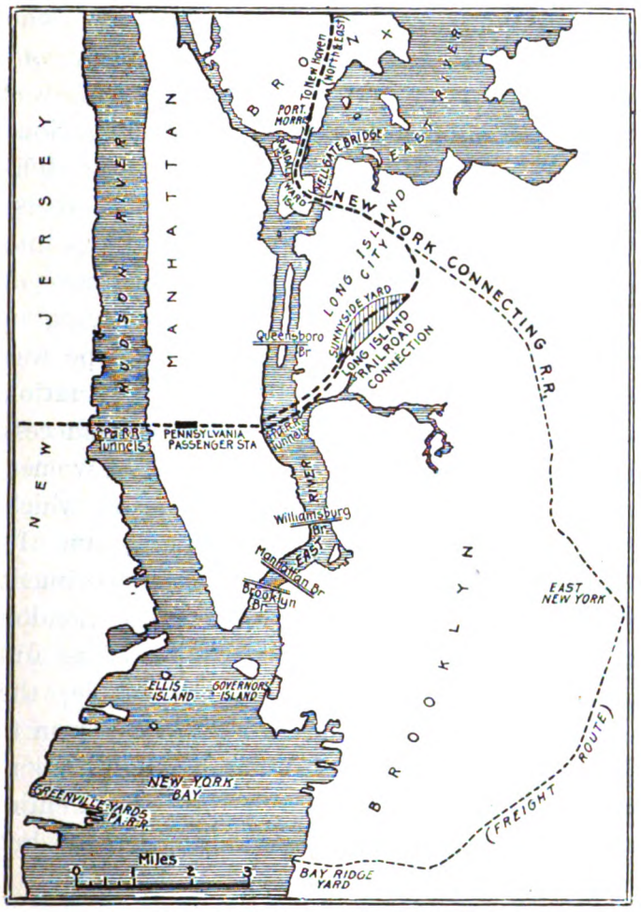
## OPENING OF HELL GATE BRIDGE, NEW YORK.

An engineering event of much importance from the standpoint of transportation was the opening to traffic on April 1 of the Hell Gate Bridge, the masterpiece of Dr. Gustav Lindenthal, chief engineer, which forms the final link of the New York Connecting Railroad between the New York, New Haven and Hartford and the Pennsylvania systems.

For years New York City may be considered to have been the dividing point in the railway lines radiating from it in all directions. Both passengers and merchandise arriving in New York from the south or west had to be transferred in order to go east and north. The building of the Pennsylvania Station on Manhattan and the construction of the tunnel under the East River to connect with the Long Island Railroad was the first step in the project to provide through trains and to reduce the ferry distance for the transhipment of freight at New York.

The course of the New York Connecting Railroad is indicated on the map. In the Bronx the line leaves the N.Y., N.H. and H.R.R., spans one after another the Bronx Kill and Little Hell Gate, and




New York Connecting Railway.

crosses Randall's Island. Then, by a sweeping curve through Ward's Island, it turns eastward and passes by the new Hell Gate Bridge to the Long Island side of the East River. The Connecting Railroad then continues through Long Island City, and, turning to the west, joins the Pennsylvania Railroad tracks at the Sunnyside Yard. The passenger trains, drawn by electric locomotives, proceed through the tunnels under the East River and Manhattan Island and the Hudson River *en route* to the West; but goods trains go by a belt line around Brooklyn to Bay Ridge on New York Bay. From this point the cars are taken by ferry to the Pennsylvania Railroad terminal at Greenville on the New Jersey shore.

The bridge and viaduct portions of the line from 142d Street in the Bronx to Sunnyside Yard on Long Island was a difficult part of the construction. Three miles of it consist of steel spans on concrete piers, with one mile on an embankment, retained between high concrete walls held together by tie-rods. Apart from its importance as a traffic route, the Hell Gate Bridge is also a notable engineering construction, as it has the longest and heaviest steel arch in the world. It is remarkable also for its beauty of outline, due to the collaboration between its designer and the architect, Mr. Henry Hornbostel. The following data are from the *Engineering News* (New York):—

Span, 1,016 ft. 10 in., between tower faces; 995 ft. $1\frac{3}{8}$ in. between centres of bearings.

Arch, height from centre of end hinges to centre of top chord, 140 ft. at ends, 260 ft. at centre. Height to centre of lower chord, 220 ft. Greatest height above mean high water, 310 ft. Clearance above mean high water, 240 ft.

Towers, height above ground, 240 ft.

Width, 93 ft. between centres of railings; 60 ft. between centres of trusses.

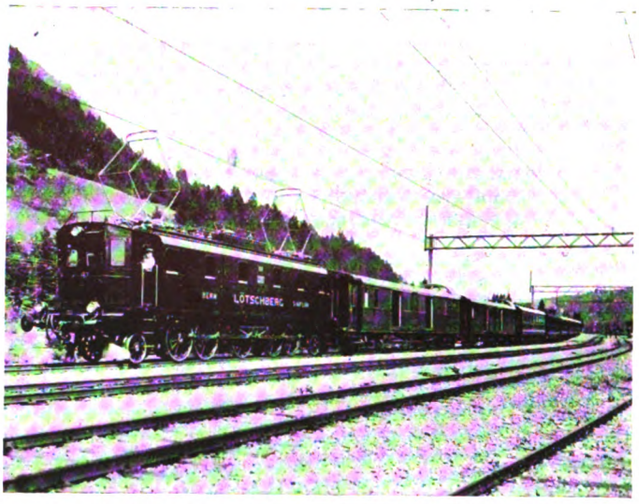
Bottom chord, $6\frac{1}{2}$ ft. wide, $11\frac{1}{2}$ ft. deep at ends, $7\frac{1}{2}$ ft. deep at centre; maximum section, 1,384 sq. in.

Heaviest single piece, 185 tons (shipping weight, 150 tons).

Load, the arch carries four tracks on ballasted concrete floor; total dead load, 52,000 lb. per lin. ft. of bridge.

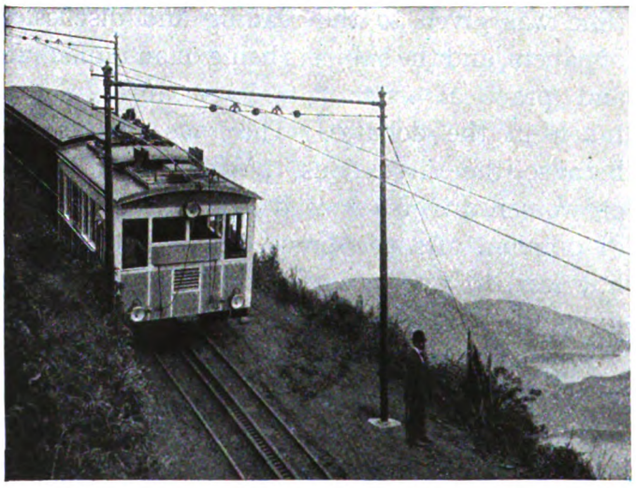
## OERLIKON SPECIALITIES.

The British and Colonial department of the Ateliers de Construction Oerlikon, Oswaldestre House, Norfolk Street, London, W.C., have sent out a handsomely illustrated 64-page booklet containing numerous pictures of the electric and other machinery manufactured by the company. Generators, turbines, motor generators, motors, transformers, switches, relays, and so forth, are shown in great




Single-phase Locomotive with two 1,250-h.p. Motors. 15,000/400 volts.

variety. We reproduce here views of two electric locomotives with motors of Oerlikon make. Manufacturing has not suffered so much from war conditions in Switzerland, where the company's works are situated, as in many other countries, and it is possible to work to relatively reasonable delivery schedules. The importation of raw materials into Switzerland from America and Great Britain is receiving all the attention it merits, and facilities, such as are offered



Three-phase Locomotive with two 155-h.p. Motors. Coreovada Railway, Brazil.

by the Société Suisse de Surveillance Economique, and by the attestations from the Ministries of Munitions of the Governments of nations allied to Great Britain, also the loyal execution of the company's undertakings and guarantees to the Governments involved, make it practical for the Oerlikon Works to maintain their manufacturing processes to a large extent. They are therefore frequently in the position to assist clients in connection with urgent work.



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THE
# Tramway AND Railway World

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LONDON, JULY 12, 1917.

**The Tramway Congress.** Taking present circumstances into account, the ninth annual congress of the Tramways and Light Railways Association, which is reported in full in this issue, must be considered highly successful. The members met again under war conditions, but from the business point of view it was more thorough than last year's gathering. A longer time was given to the reading and discussion of papers, and the subjects being of an immediate and practical nature, a lively interest was taken in the debates. This was the greater because the discussions, particularly the one on women drivers, showed plenty of divergence of opinion. As the proceedings were limited, however, to one afternoon, and as the reading and discussion of the first paper, which was illustrated with numerous lantern slides, photographs and diagrams, took up considerable time, there was less opportunity than desirable for the remaining subjects. Want of time, however, is a common complaint at such conferences, as organisers succumb to the recurring temptation to present numerous good subjects, and debate on the earlier ones sometimes leaves little room for those coming later. The manufacture, life, and maintenance of tramway car tires were dealt with thoroughly in the paper by Mr. Arthur Norton, while the numerous illustrations relating both to manufacture and to wear in use were highly informative. Several tramway managers who spoke from their own experience indicated clearly the difficulties encountered in efforts to minimise wear and tear. Mr. A. V. Mason, in introducing the subject of return fares, suggested among other things a system under which passengers making the longer journeys should be carried a greater distance for each penny of the fare. A notable proposal came from Mr. E. H. Edwardes, who opened a discussion on standardisation of conditions of labour and rates of pay. This was the formation of tramway federations in various areas to deal with such subjects. Some difficulties were pointed out by various members, such as getting all municipal undertakings into the proposed federations and the difference of conditions as to wages and cost of living in different parts of the country. The hope was expressed that the Council of the Association would go into the question. The great success which has attended the employment of women drivers in Greenock was the theme on which Mr. A. Robertson opened a discussion. In Paisley, it appeared later on, the experiment has not been very successful, while in London it cannot be tried owing both to police and trade union objections. On the whole, the members of the Association had good reason to be satisfied with a useful and practical afternoon, and they dined together quietly in the evening without formality and without speeches, but with much social conversation.

**Higher Fares in America.** The urgent necessity for higher fares which has been particularly felt in connection with tramways in this country during the past two years is also a matter which has assumed the highest importance in relation to the street railways of the United States. The uniform fare of five cents for any distance within town and suburban limits has been the rule away back to the horse-car days. Coupled with it is the right of transfer to another car taking a different route without paying any additional fare. The latter privilege is taken advantage of to such an extent in the large cities that in New York, for example,

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the average fare received per passenger trip is only 3½ cents instead of five. Working expenses have, of course, always been fairly high, as most things are dearer in America than in this country. In recent years these operating costs have steadily been going up, and since the war began they have advanced enormously, owing to increases of wages and of prices for everything. Now that America is in the war matters are likely to become still worse. Meantime they have reached a point where some of the companies declare that the only alternatives to higher fares are bankruptcy or public ownership, in which latter case, of course, the loss would fall on the ratepayers. In May last a definite movement was inaugurated among electric railway companies in the States of New York and Pennsylvania in favour of increased fares, and it is now beginning to spread to other States. In some of the States the companies are not able to raise fares without the consent of the public bodies which govern street railway undertakings, and which have much greater powers of control over them than the Board of Trade has over tramways in this country. These Public Service Commissions indeed have quite autocratic powers within their own sphere of action. Recently the New York Railways Company, the Brooklyn Rapid Transit Company, and the Third Avenue Railway Company made application to the Public Service Commission for the First District of New York—that is for the city as apart from the State—for authority to make a charge of two cents for a transfer. This the companies consider more suitable to the local conditions than raising the ordinary fare to six cents. The hearing of the applications was to begin on June 6, and it may be some little time before decisions are given. In the State of New York, outside the city, the proposal is that fares should be increased to six cents. The Pennsylvania Street Railway Association has a special committee considering the desirability of concerted action on the subject of higher fares. Some public opposition has arisen to the movement, although the companies can show that the continued and unavoidable increase of working expenses is placing them in a perilous financial position. What Public Service Commissions may do it is not safe to prophesy. One remembers, by way of analogy, the scanty concessions made by the Inter-State Commerce Commission to the great steam railways of the Eastern States in the matter of freight rates. The street railway companies must hope for the best.

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**Coal Supply and Electricity Supply.**

Both of these subjects were before the annual meeting of the Municipal Electrical Association on June 21 and 22. Electric power and lighting stations generally feel difficulties in connection with the supply of coal, both as regards quantity and quality. A notable event was a speech by Mr. Guy Calthrop, the Coal Controller, who attended the meeting in order to appeal to central station engineers for assistance in saving coal. In return, members of the Association had many representations to make to Mr. Calthrop as to their troubles in obtaining coal. He invited them to submit full details, so that communications are likely to result which may be of benefit to the central stations, and may also lead to further coal economies. The other matter of importance before the meeting was the great increase in electricity supply owing to the heavy demands for Government work and the related subject of the Government's Electric Power Supply Committee. That again leads on to the demand for a reorganisation of the State control of the industry. As to the Power Supply Committee, the Association have now had three more municipal representatives appointed to that committee, the feeling evidently being that municipal interests were not getting fair play as compared with company-owned undertakings. There appears to be a widespread idea that the Ministry of Munitions refuses municipal undertakings facilities for extending their plant, while granting such facilities to power companies. To a certain extent this fact—if it is a fact—may be explainable on the ground that it is preferable to extend large power stations rather than small and uneconomical ones. More definite information is wanted on the subject, and a frank statement by the Government departments concerned would also be of value. It is certainly to be desired that there should be no friction in connection with the Power Supply Committee, but that all parties should work together.

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## THE BRITISH TRADE CORPORATION.

There is much reason for gratification that so large a measure of approval was given by the House of Commons on June 14 to the amended constitution of the British Trade Corporation that the way was cleared for those responsible for this great project to go ahead with their organisation. It may be remembered that when the scheme was before the House a few weeks previously there was a good deal of hostile criticism of details of the charter of incorporation. The opposition arose principally from the point of view that the Corporation might compete with traders, though its avowed object was to help them. At the time we were of opinion that the criticisms were largely factious, but however that may be they lost their point after the issue of an official memorandum on behalf of the proposed bank making certain specific declarations.

The granting of a charter to the Corporation and the main provisions of it were in accordance with the recommendations of a committee appointed by the Government, and presided over by Lord Faringdon, who is now the chairman of the new institution. With an authorised capital of £10,000,000 the Corporation ought to be of great assistance in enabling British manufacturers and traders to finance their overseas developments, and to obtain reliable foreign trade information to an extent which has not hitherto been possible.

Sir Albert Stanley, President of the Board of Trade, mentioned, when the subject again came before the House on June 14, that he had given careful thought to the points raised in the previous debate. The White Paper which had been circulated set out the formal declaration of the Corporation, and made it quite clear what obligations were imposed by the charter. The Corporation, he declared, would not operate as a competing contractor, merchant, or trader. The declaration also made it clear that no special privileges were conferred on the Corporation as regards access to Government information or placing them in any preferential position. He was advised by the Law Officers of the Crown that this declaration was absolutely binding on the Corporation.

Some of Sir Albert's points in regard to the matter call for reproduction. There was, he showed, imperative need for such an institution in this country. Whatever steps were possible should be taken to help those engaged in trade and industry to meet the altered conditions after the war. There was need of an organisation with great financial resources and having associated with it experts in various industries who had a knowledge of what was required to establish a new business on a sound basis. It would have been possible to form a private company for the purpose, but in that case a subsidy would have been necessary in order to get the right business men. The alternative was to follow the recommendations of Lord Faringdon's committee, and that was what had been done. There was no subsidy and no agreement. Lord Faringdon had been very loth to take the responsibility of forming the Corporation, and he was, along with those acting with him, entitled to the thanks of the House.

Most of the criticism which followed was favourable, and Mr. Bonar Law (the Chancellor of the Exchequer) delivered a speech containing some interesting matter. Amongst other things, he said that there should be some means by which young men without the capital of their older competitors should have a chance of getting credit which would enable them to establish new lines of business. When the war was over, what would be needed more than anything, and what would be difficult to get, would be the credit without which trade and industry would become paralysed. For that reason he regarded the proposed bank as a good thing. Another aspect to which he gave prominence was this. When the war came to an end the German banks which had been doing great business in this country would be in a different position. The credit which traders had got from them had gone, and it had to be replaced, and it would be extremely foolish to turn down any effort to place greater credit at the service of our traders and manufacturers. Mr. Bonar Law also insisted that no preference was given to the Corporation over existing institutions. The Government were ready to give the same facilities to any similar body of men who would undertake to do the same kind of work.

On June 27 the British Trade Corporation issued a prospectus inviting subscriptions from the public for 150,000 shares of £10 each at par. The authorised capital is £10,000,000 in £10 shares, and 100,000 shares had already been subscribed. These, with the shares offered by the prospectus, make a total value of £2,500,000, which is evidently the total capital to be issued at present. There are 16 directors, all gentlemen of high standing in the financial and manufacturing world. The following is extracted from the prospectus:—

The Corporation will specially devote its energies to the development of the trade of the British Empire in every part of the world. It will provide financial facilities, the currency of which may extend over a longer period than is covered by the usual advances made by bankers, and it will be prepared to assist in opening up new channels for enterprise where it is demonstrated that financial aid can be afforded without undue commercial risks. The Corporation will further the co-ordination of interests in the case of British commercial and industrial undertakings, as well as afford financial assistance for the enlargement of works and the extension of plant with a view to effecting economies in the cost of production. There exists to-day no large British financial institution possessing an industrial department or an organisation for study and research into new ideas or inventions, which is specially equipped to examine and nurse new schemes or developments until sufficiently proved and ripe for public investment. The Corporation will make this a special feature of its business, and will aim at becoming a link between British industry and the British investor. It will take a lead in the formation of syndicates to deal with business of promise and importance, and it will associate with itself other banking and financial institutions which care to participate in its operations.

The Corporation proposes to appoint representatives in the chief cities of the world who will be domiciled with the bank holding the Corporation's agency. Where similar arrangements are not practicable it is intended to open branch establishments in important centres abroad. The Corporation will establish information bureaux to collect reliable data upon openings for foreign trade, new contracts, State and other loans, and issue proposals. The Corporation will open a credit department for the issue of credits at home and abroad. It is believed that the Corporation will be able to earn from the various directions indicated above a fair dividend from the commencement, and that the pioneer work that it will undertake forthwith will provide an adequate return upon its capital when normal times recur. The charter of incorporation is for a period of sixty years, when, as the prospectus naively says, a renewal will have to be applied for.

## COAL GAS ON BATH OMNIBUSES.

Mr. W. E. Hardy, general manager of the Bath Tramways Company and their omnibuses, regards the introduction of coal gas for omnibus working as purely a war-time expedient to meet the difficulty of the petrol scarcity. Experiments have shown that considerable economy is obtained under the present conditions. The gas is at present used on the omnibuses running on the Frome to Midsomer Norton route, where the vehicles have to travel eleven and a half miles over very hilly routes, including the steepest to be found in that part of Somerset. On Midford Hill there is a gradient of 1 in 8. The gas-holders, which are placed on the top of the omnibuses, cost from £30 to £40 apiece, and the exact extent of the economy cannot be determined until it is seen how long these holders will last. Some time is required to refill the gas-holder, which is done with a junction at the ordinary main. If the gas runs out on the journey, petrol is ready to be used, the change being made by the driver turning on a tap at his seat. Mr. Hardy states that it is not at present possible to get the same standard of power from the engine by the use of gas as is obtained with petrol. By the use of gas the company have reduced their petrol consumption by 68 per cent.

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# Tramways and Light Railways Association

## Ninth Annual Congress, held in London, June 29, 1917.

The annual general meeting and congress of the Tramways and Light Railways Association was held on Friday, June 29, 1917, at the Institution of Civil Engineers, Great George Street, London, S.W. The chairman of the Council, the Hon. Arthur Stanley, M.P., presided.

The Secretary, Mr. A. de Turckheim, having read the notice convening the meeting and the auditor's certificate, the chairman moved the adoption of the report and accounts.

### The Hon. Arthur Stanley's Address.

The Chairman.—Once again, owing to the war, we have decided to curtail our annual congress to a one-day meeting, and I think you will agree with the decision of our Council that under the circumstances it is best to do without the usual functions and entertainments and to confine ourselves to the business side of the congress. We appreciate under what a strain you are all working and how difficult it must be for you to leave your work even for a short time. But we felt that it would be a pity to forego this one opportunity during the year to meet together and to discuss the many problems with which you are faced owing to the abnormal times in which we are living. I extend to you a hearty greeting, including those of you who are not members of our Association, whom we welcome here to-day to take part in our deliberations and discussions. I think you will also like me to say a word with regard to those many members of the tramway industry, both among the officials and staffs, who are away on active service. I am glad to think that as an industry we have not been backward in doing our share —far from it—and to all those who are away we send a message of encouragement and goodwill coupled with our sincere good wishes for their safe return.

I will now say a few words with regard to our accounts. The revenue from subscriptions amounted to some £730, as against £775 last year, a falling off of some £45, due of course to the fact that more men have been called away, and we are not asking them to contribute to our funds during the war. The expenses amounted to £647, as against £635, a slight increase of some £12. Adding £25 for interest on deposit and War Loan, and after writing off £13 13s. on subscriptions account, we show a net excess revenue over expenditure for the year of £91, which, added to the balance brought forward from previous years, gives us a total balance of £521 14s. 6d. to carry forward. During the year we added another £200 to our previous investment of £300 in Government War Loan, making a total of £500 and leaving us with no liabilities.

We have again to record the death during the year of two of our vice-presidents, Sir George White, of Bristol, who so loyally supported our association for so many years, and Mr. Hall Blyth, whom you all remember as our generous and excellent host at our congress at Edinburgh in 1911. Although not a member of our association, I should like to refer to the loss sustained by the many friends of Alderman Brodie, of Blackpool, who you will also remember so greatly contributed to the success of our congress at Blackpool in 1913. I am sure you will join with me in expressing our sincerest condolences with their relations.

Coming back to the affairs of the association, I may say that this has been a very strenuous year, and we are glad to think that the association has been of some little value and benefit to its members. It is also gratifying to note that the many Government departments have made full use of the association as a medium for dealing with its members. Among the many matters which have occupied us during the year, I might mention the following :—

*Leaving Certificates.* It took some little time to obtain it, but we finally got the Order we asked for from the Ministry of Munitions. It was a case of "better late than never"; now, however, as you all know, leaving certificates have been abolished. Then as to—

*Substitution*, a special department of the War Office took up this matter with us, and although the results may have been somewhat disappointing, on the whole it was well worth the trouble, and a good number of our former employees were returned to us. It is to be hoped that the arrangement may develop further. With regard to –

*Supply of Materials*, this is perhaps the most difficult of our subjects. You all need materials for repair and maintenance, and you very naturally consider that your case should have priority over all the others; but in view of the shortage due to war conditions there is not enough to go round, and there must inevitably be delays and disappointments. We must hope that the great pressure of the present may soon be relieved and that the Government departments may be in a position to allow us increased rations. In order to relieve this strain, the Government assisted us by holding up materials ready for shipment abroad and offering us the chance of utilising them. I am glad to say that in several cases substantial relief was given in this way. In another way the Government were able to help by granting certificates for importing from America. It was obvious if we could not get home supplies and our tramways were to be kept running, we must be allowed to import from our Allies, and this is now being done satisfactorily, if somewhat more leisurely than we might wish, owing to the fact that different departments are dealing with the matter and that delays are thus incurred. We have also been able to assist each other, and the weekly (I am afraid it was sometimes only monthly) lists of materials issued by the association to its members have led to mutually satisfactory results. (Applause.)

One of our committees was occupied for over a year, together with four other associations, in negotiations with the Inland Revenue Authorities in order to obtain a standard rate of depreciation allowances for motor omnibuses, and I am glad to say that the arrangement come to was accepted as a fair one by all our members.

With regard to general matters, I may add that other committees of the association are busy at the present time considering the question of disabled sailors and soldiers, increase of fares, national insurance (munition workers), and national service (substitution), and we are grateful to those of our members who are giving up much of their valuable time to these matters. The Board of Trade has appointed a Departmental Committee on the Supply of Electricity, and it may be that we shall again be asked to send a representative to give evidence on our behalf. Mr. Sellon, who gave such valuable evidence last year before a somewhat similar committee, will doubtless again come to our assistance should the necessity arise.

The question of women drivers is causing, I understand, a good deal of heartburning, and since we are to hear more about it this afternoon, I will not do more than refer to it and express a hope that no life-long friendships will be shattered in the discussion of this topic. In view of the new list of certified occupations which, by raising the age limit of some of your men, will deprive you of their services, the women driver question is one which must occupy your most serious attention, notwithstanding the many difficulties entailed thereby.

These are, I think, the chief subjects of our labours, though there are a good many minor ones which it would take too long to enumerate. The conditions vary almost from day to day, and I am afraid you have to put up with many difficulties and annoyances, but I do think that in view of all the circumstances it is quite extraordinary how you have been able to maintain and improve your services in the face of all difficulties. The very greatest credit is due to you all, and I heartily congratulate you on the splendid work you are doing. What the society has done shows that we were right some years ago when we decided that it should continue and should not be allowed to die. (Applause.)

Now I shall propose the first resolution, viz.: "That the accounts and balance sheet for the year ended December 31, 1916, be approved and passed," but before I put it to the meeting, if there are any questions, perhaps you would like to ask them.

Mr. Harry England formally seconded the motion, which was carried unanimously.

The Chairman.—Before submitting the next resolution for the election of seven new members of the Council in place of those retiring under the articles, I wish to express our sincere thanks to those retiring members, and first and foremost to Mr. England, who has been our vice-chairman during the last five years and who has so ably and untiringly served the association during these difficult times. Mr. England is one of those lucky men who have no enemies and hosts of friends, and we shall all miss him and his genial presence among us. As chairman I am particularly grateful to him for taking my place when other business prevented my attendance. Mr. Howley, whose name is on the leaving list, is



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recommended for election as vice-chairman, so that we shall not be losing him, and I am sure he will make an able successor to Mr. England. The other members whom we are to lose are Messrs. Mallins and Greene, two municipal members from Lancashire and Cheshire, and Messrs. Mason and White, two company managers, and last of all Mr. Bland, the representative of the manufacturing side of our business, who may be described as one of the tramway veterans. I wish particularly to thank Mr. Bland for the help he has given us as chairman of our Rail Committee and for the hard work he has put in on your behalf, with such excellent results. The Council recommend to you for election the following seven members: Mr. R. J. Howley, vice-chairman; Mr. A. Good, director of Cammell Laird and Company, to take the place of Mr. Bland as representing the manufacturers; Mr. G. W. Holford, of Salford; Mr. W. E. Hardy, of Bath; and three old friends, Mr. C. G. Tegetmeier, Mr. T. B. Goodyer, Croydon, and Mr. W. Thom, Potteries. I move their election.

This was formally seconded and agreed to unanimously.

Mr. H. R. Hogg moved that Mr. A. W. Chambers, the retiring hon. auditor, be reappointed to that office, and that the thanks of the association be conveyed to him for his past services.

Mr. W. T. Robson seconded and the motion was adopted.

Mr. Howley.—Before we part I think that we ought to accord Mr. Stanley a hearty vote of thanks for leaving the great work he is doing at the Red Cross in order to preside here to-day. We know the serious calls on his time. I am sure what he has told us will encourage us to go forward next year and complete the various matters in hand and marked for settlement. I take this opportunity of thanking you for electing me as your vice-chairman. I shall do all I can to help the association, but of course what I can do can be of little use unless I get the help of members generally and especially of the Council. But I know from past experience that I can rely upon the Council. I also look forward to a very large amount of assistance from the late vice-chairman, Mr. Harry England, who has such a wide knowledge of the business and a perfect grasp of its details and intracacies. I have very much pleasure in proposing a hearty vote of thanks to our chairman, Mr. Stanley. (Applause.)

The Chairman having briefly acknowledged the compliment, the proceedings of the ordinary general meeting concluded and were followed by the

### NINTH ANNUAL CONGRESS.

The Rt. Hon. Viscount Chilston, president of the association, occupied the chair.

The President, in opening the proceedings, said:—I wish to extend to you all a hearty welcome. I can assure you that I think it is very remarkable that at a time of stress such as we find ourselves in to-day so many gentlemen from all over England who are interested in our work should meet here on this occasion. We all know how difficult has been your work during the past year. The loss of staff which you have sustained during the progress of the war, the difficulty of obtaining labour, the necessity which has arisen of completely reorganising your forces, might all well have been causes to keep you away to-day. All those who are engaged in work such as we carry on have been surrounded with difficulties. Not only have you had the labour difficulty, but you have also had the difficulty of obtaining material. You have had that difficulty not only for new construction—where new construction has been attempted—but also for ordinary repair of the roads. The difficulties of the war have shown, I think, how necessary tramways have been and are for carrying on the traffic of the country. In many of our great industrial centres where munition workers have to be carried, I think it would have been almost impossible to get these people to and from their residences and the factories in many cases had not our tramways existed, and all those who have been engaged in war work, whether professionally or voluntarily, have realised the great assistance which tramways have given to them. I have not come here really to open the congress or to lead it; I intended to sneak in and learn a little bit of your business here, for I felt that hitherto my position in the association has been a very easy one and a very pleasant one. I wish I could have had more opportunities of seeing the more serious side of the work of the association. But, now, having welcomed you to this congress, I do not mean to detain you further, but to listen as an amateur to the remarks of men who thoroughly know the subject on which they are engaged. I therefore call on Mr. Norton to open the first discussion.

## THE MANUFACTURE, LIFE AND MAINTENANCE OF TRAMWAY CAR TIRES.

By Arthur Norton, A.M. Inst.C.E., A.M.I.Mech.E.

### Processes Employed in Making Steel.

Tires may be made by either the Bessemer or Siemens-acid processes from selected hematite pig-iron, carefully mixed with suitable scrap. The process of conversion into steel having been duly completed, the charge is then tapped from the furnace, or poured from the Bessemer converter into a ladle, preparatory to its being cast into ingots.

### Ingots and Ingot Casting.

For the production of tram tires, or any other steel manufacture, it is, of course, of vital importance that the steel ingot, the raw material which we commence upon, should be of the very best. No less than two admirable papers have recently been read before the Iron and Steel Institute by Messrs. A. W. and H. Brearley, and a further two by Mr. J. N. Kilby, on this most important subject of ingots and ingot casting. One therefore cannot do better than recommend these papers to your perusal, containing, as they do, a full description of what is generally recognised as the best and latest practice.

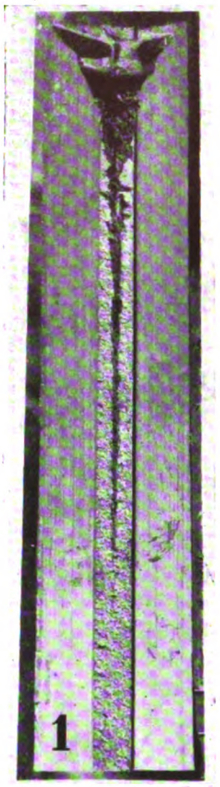


Fig. 1.

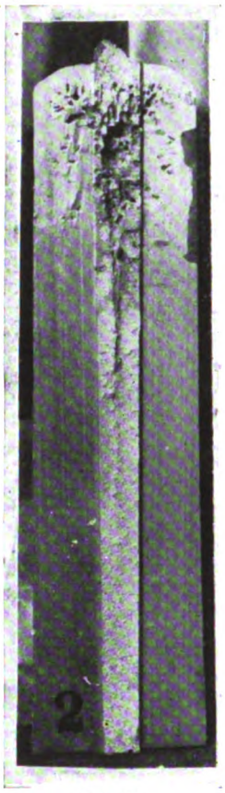


Fig. 2.

Defective Ingots.

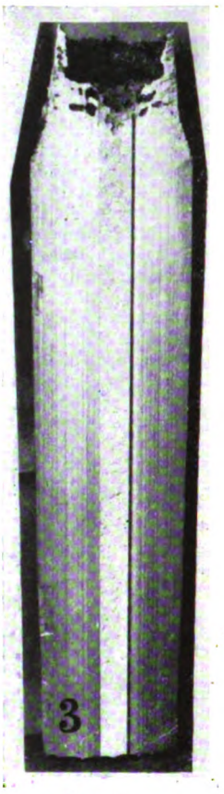


Fig. 3.

Sound Ingot.

The accompanying illustrations, Figs. 1 and 2, show defective ingots, being piped down the centre, whilst Fig. 3 is perfectly sound throughout its length. The author therefore starts off on the manufacture of tram tires with what the American would no doubt describe as "some" ingot.

The ingot, having been suitably re-heated, is forged under the press and cut off into square lumps, of a suitable size and weight, from which the tires are ultimately made. These lumps are forged under the hammer, first of all by knocking the four corners down into an octagon form, subsequently flattened to the shape technically known as a "cheese." A hole is then punched in the centre, and further forging of the solid ring is proceeded with, until the desired size necessary for the roughing mill, or becking hammer, is obtained. These rings, having been re-heated to a nice working heat, are now shaped into the form of the tire, either on a powerful roughing mill or given the desired form under the becking hammer. The roughly-formed tire is further re-heated, and finished to the desired dimensions on the tire mill.

### Marking and Pairing of Tires.

Upon completion of the rolling process the tire is stamped whilst hot with the maker's name, year of manufacture, and cast number, care being taken to stamp the tires as near as possible to the inside diameter, so that the marks shall not be obliterated by wear. In this connection it is of very great importance that all sharp notches,

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whether in the form of letters or markings, be carefully avoided, and marks should not be stamped deeper than is absolutely necessary.

In rolling a large quantity of tires there will always be found a certain amount of tolerance in the outside diameters, so before proceeding with the machining of the tires it is as well to pair them as far as is possible. In numbers of cases the tires are put into service without being turned on the tread and flange, but in those cases where they are turned unnecessary machining is saved by this little attention.

### Gauges and Gauging.

The accurate gauging of the bore of the tire is of extreme importance, as it is very essential that the standard shrinking allowance of 1/1,000th of the diameter of the wheel centre shall not be either above or below the limit fixed. It is a moot point whether sufficient importance is attached to this question, as also to the use of a really suitable material for the manufacture of gauges; for it may be pointed out that the surface points of both the inside and outside diameter gauges being so small, a certain amount of wear is inevitable, which can be easily added to by the rough usage to which such gauges may be subjected in the hands of rough and careless workmen. Some such special steel as "Quickstep," with hardened and tempered points, would suit admirably for this purpose.

It is also of great importance to have the master gauges kept in safe custody, so that the gauges used in the shops may be proved from time to time. Unless this precaution is adopted, the contraction allowance, on the inside diameter gauge, may very readily be exceeded, with the resulting consequences of broken spokes in the wheel centres, or even the actual bursting of the tire. This is especially liable to occur in those cases where more than the standard allowance for contraction has been allowed.

There are records where as much as $\frac{1}{8}$ in. allowance has been made in tires for contracting on to centres (with straight spokes), having a diameter round about 26 inches, to which allowance may be added a possible further amount due to the worn state of the gauges, as indicated above.

The allowance for contraction in a tire would no doubt have to be increased when wheel centres are designed in such a way that the rims are not in alignment with their bosses, wheels designed in this way being provided with "S" spokes, and the contraction of the wheel centre will therefore vary according to the greater or less degree of the curvature of the spokes.

### Apparatus for Recording Expansion and Temperatures.

An apparatus has been designed for correctly recording the exact amount of expansion and contraction that takes place at the varying temperatures upon heating and cooling a tire. By means of this recording apparatus, as applied on a $2\frac{3}{4}$-in. standard section tram tire of the following dimensions:—

31 in. outside diameter,
25-23/32 in. inside diameter,

the expansion and contraction that took place were most carefully recorded, and are set out in the form of a curve, shown in Fig. 4.

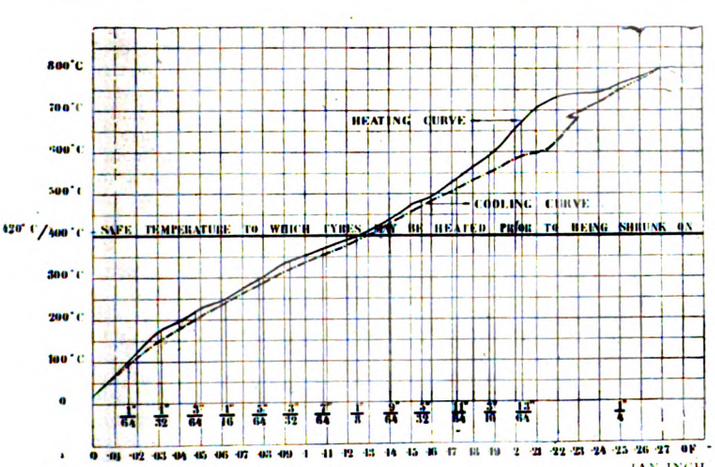


**Fig. 4.**

Heating and Cooling Curve, showing actual expansion obtained at different temperatures on a 31-in. driving tire, inside diameter, $25\frac{23}{32}$ in.

### Heating and Cooling Curve.

It may be useful to tabulate the expansion and corresponding temperatures that were recorded, which were as follows:—

| Expansion. | Temperature. |
|---|---|
| 3/64 in. | 220° C. |
| 1/16 in. | 250° C. |
| 1/8 in. | 400° C. |
| 5/32 in. full. | 500° C. |
| 3/16 in. | 600° C. |

It is frequently remarked that tires are put on at a "black heat," but it may be instructive to point out that, given a good light, a "black heat" may carry a temperature of 550° C. to 600° C., although if the shop be badly lighted this latter temperature would be a visible red.

A temperature of 650° C. would show a visible red in a well-lit shop, but in the case of tires that have been subjected to careful heat treatment the whole effect of that operation may be nullified by exceeding the safe temperature of 400° C.-420° C. mentioned below, and indicated on the diagram. Also at 650° C. one is getting dangerously near the calescence change point, when the condition of the steel is completely changed owing to the diffusion in the

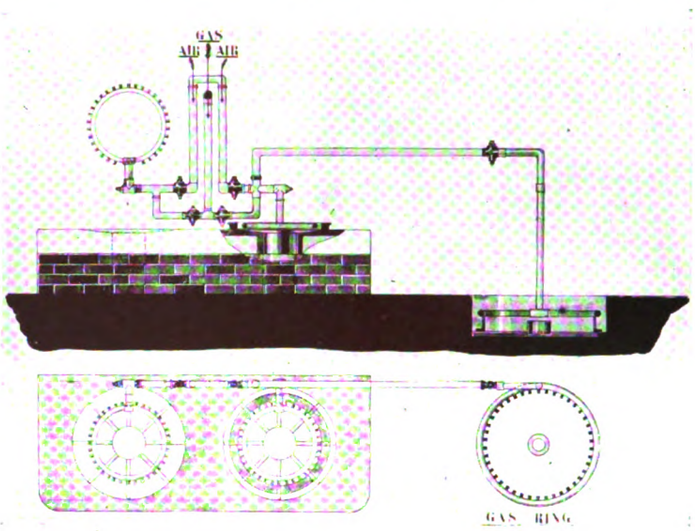


**Fig. 5.**

Belfast City Tramways Arrangement for Shrinking on Tires.

pearlite areas, and at such temperatures quenching would have the effect of partly hardening the tire. This calescence change point is shown in the heating curve round about 740° C., and in the cooling curve at 680° C. Should the calescence change point be exceeded, and the tires cooled off by the ordinary hose-pipe method, the tires will develop hard and soft places, with the result that flats are very much more readily induced when the tire comes to be put into service.

Having fixed the necessary contraction, and knowing the required temperature that is necessary to contract the tire on to its wheel centre, it is of importance to see that the temperature so fixed upon is not exceeded, and it may be emphasised that it is undesirable to go beyond the safe limit of 420° C., this being the melting temperature of zinc, and can therefore be very readily checked, as described below.

### Method of Heating Tires Prior to Shrinking on to Centres.

The tires, having been bored to the correct diameter on the tire-boring mill, are then heated on a gas ring arrangement, a very good form of which is shown in Fig. 5, which shows the actual fixing of a gas ring into a tire prior to heating. This apparatus was designed by Mr. Blackburn, of Belfast.

This arrangement allows the tire to be heated to the exact temperature required, the latter being readily checked by placing one or two small pieces of zinc on the face of the tire, the zinc being suitably covered with a metal cup, so as to retain the heat, the cup being removed momentarily in order to see if fusion has taken place.

As pointed out, it is not necessary to heat the tire to this temperature, as 1-16 in. expansion takes place at 250° C., and the tire can be very readily gauged when heated. Care should be taken to see that the desired expansion consequent on the temperature is not exceeded.

We now come to the point when the wheel centres already pressed on to the axle are carefully turned to the required diameter, the method thus adopted ensuring the wheels being concentric with the axle.

Fig. 6 shows a method designed by the Sheffield Corporation Tramways for lifting the wheels and axle into position over the heated tire, the actual lifting being accomplished by very quick acting block tackle. The wheel centre is then lowered into the tire, and the general practice adopted for cooling off the tire is the rather primitive one of applying a stream of water by means of a hose-pipe, administered by hand.

### Even Temperature During Cooling.

As every precaution is taken in the process of manufacture to keep the temperature of the tires uniform, it may be pointed out that this method is liable to produce unequal distribution of cooling stresses. A better method is to allow the tires to cool off slowly

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in the atmosphere, but this is not always possible, owing to the time that is required for such an operation. It is therefore advisable to instal a perforated ring, and through the perforations provided water is allowed to play freely on to the surface of the tread of the tire. This perforated ring is shown in position in Fig. 6, the volume of water applied being controlled by means of a hand-cock, so that the rate of cooling can be controlled at will.

### Removing Worn-out Tire.

Fig. 5 also illustrates the method adopted in Belfast for removing a worn-out tire. The pair of wheels are placed in such a position

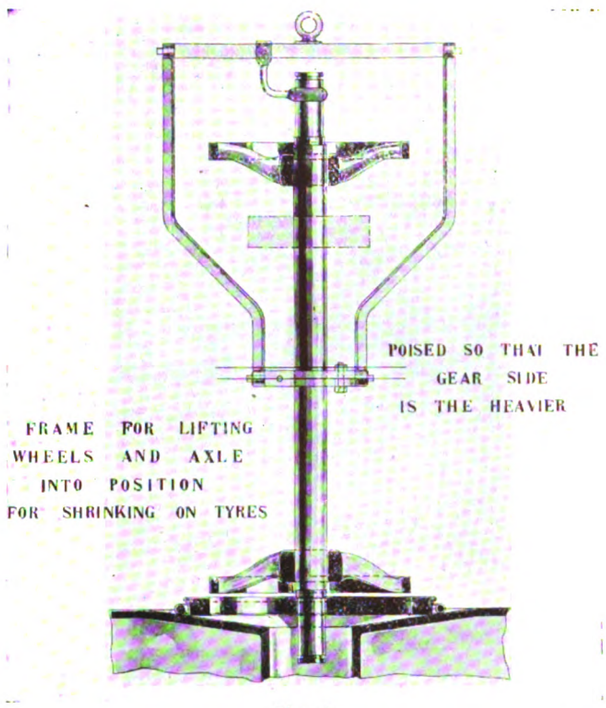


**Fig. 6.**

Method designed by Sheffield Corporation Tramways for lifting wheels and axle into position over the heated tires.

that the gas plays freely on the tread of the tire, the time required for the operation, from the time it is placed inside the gas-ring, being seven minutes.

### Fixing Wheel Centres to Tire by Means of Studs.

The practice of fixing the tire to the wheel centre by means of studs was formerly in more or less general use, but on such big

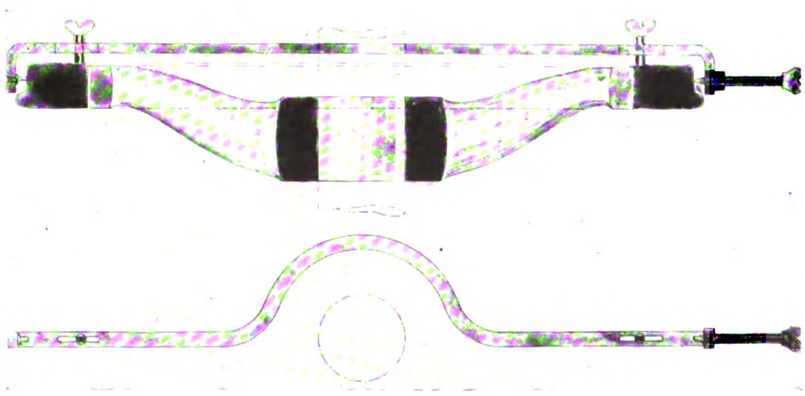

**Fig. 8.**

Outside Diameter Gauge.

systems as Glasgow it has been discarded altogether as being unnecessary. There is grave objection to boring holes in tires, necessitated by the above practice, as each of the holes forms a notch in the body of the tire, from which fractures may readily start, and especially in those cases where the tire is nearing the end of its life.

Fig. 7 shows a general view of the Belfast wheel shop, and in the left-centre is shown Mr. Blackburn's radial arm drilling machine for drilling and tapping the stud-holes described above, the machine being actuated by one man. (The Tramway and Railway World, February 12, 1914.)

### Flats on Tires.

One great advantage of the adoption of the steel-tired wheel over the cast-iron chilled wheel has been the comparative freedom from flats, which so readily obtained in the latter, especially when the chilled portion had worn away; but no doubt the opportunities of producing them at the present time may be more frequent, owing to the type of labour available for drivers being possibly not quite so skilled, as in the days preceding the attempt of the German Emperor to rule the earth.

### Care of Tires During Life.

It is of vital importance that the question of wear should be very carefully observed and recorded, so that anything in the way of

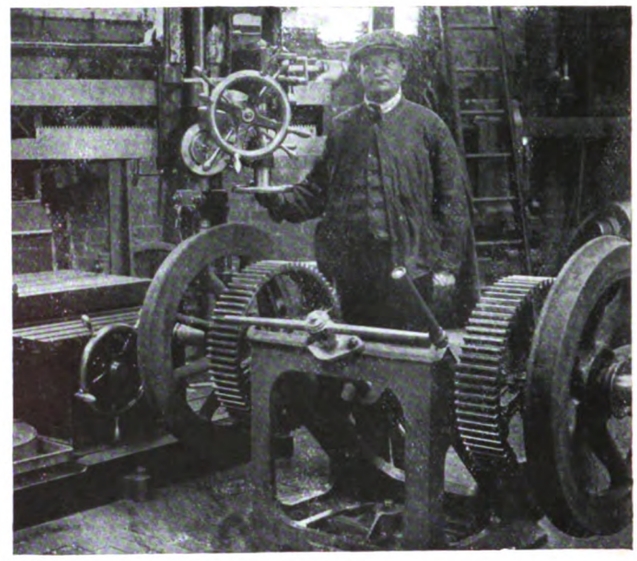

**Fig. 7.**

Radial Arm Drilling Machine in use at Belfast.

abnormal wear to tread or flange may be corrected before it has gone too far, or, what may be of still greater importance, the cause of such deterioration may be detected and corrected accordingly. An apt illustration of this came under the author's notice some years ago, when investigating the wear of certain tires that had been the cause of complaint. The cars under which these tires were running were of the bogie type, and it only required a very cursory glance at the wheels as they stood under the car in the running-shed, to see the primary cause of the trouble. This may be briefly explained by stating that the cars, having negotiated a curve, the bogies had been unable to get back into alignment, owing to the very badly-worn state of the bogie centres, the centre having eaten into the bolster to the extent of ½ in., which in turn had caused the guides to seize, the trouble being further accentuated by the entire absence of lubricating matter. Now had these cars been properly overhauled the tires would never have got into such an abnormal condition, as the cause for such wear, revealed as it was by a most cursory examination, should have been at once removed.

### Maintenance of Flanges.

In considering the question of tire wear it is always important to remember that the wheel flanges play a very significant part in steering the car through the various points, crossings, and curves, and it therefore becomes a matter of vital importance to see that the flanges are properly maintained so as to avoid any risk of derailment, with more or less serious consequences. In addition, the amount of side-play is reduced—an important consideration when one takes into account the increased wear to both tire and rail, which is bound to take place when too much lateral movement is allowed.

It is therefore advisable to send the wheels into the shops for re-turning at that point in their lives, when the flanges can be re-formed with the least possible loss of metal on the tread, and for further guidance it may be useful to quote the practice adopted in Belfast, which may be summarised when any of the following conditions obtain :—

(1) When the tires on one pair of wheels have worn to different diameters.

(2) When the inside of the flange becomes approximately at right angles to the tread, thus forming a definite corner on the tire.

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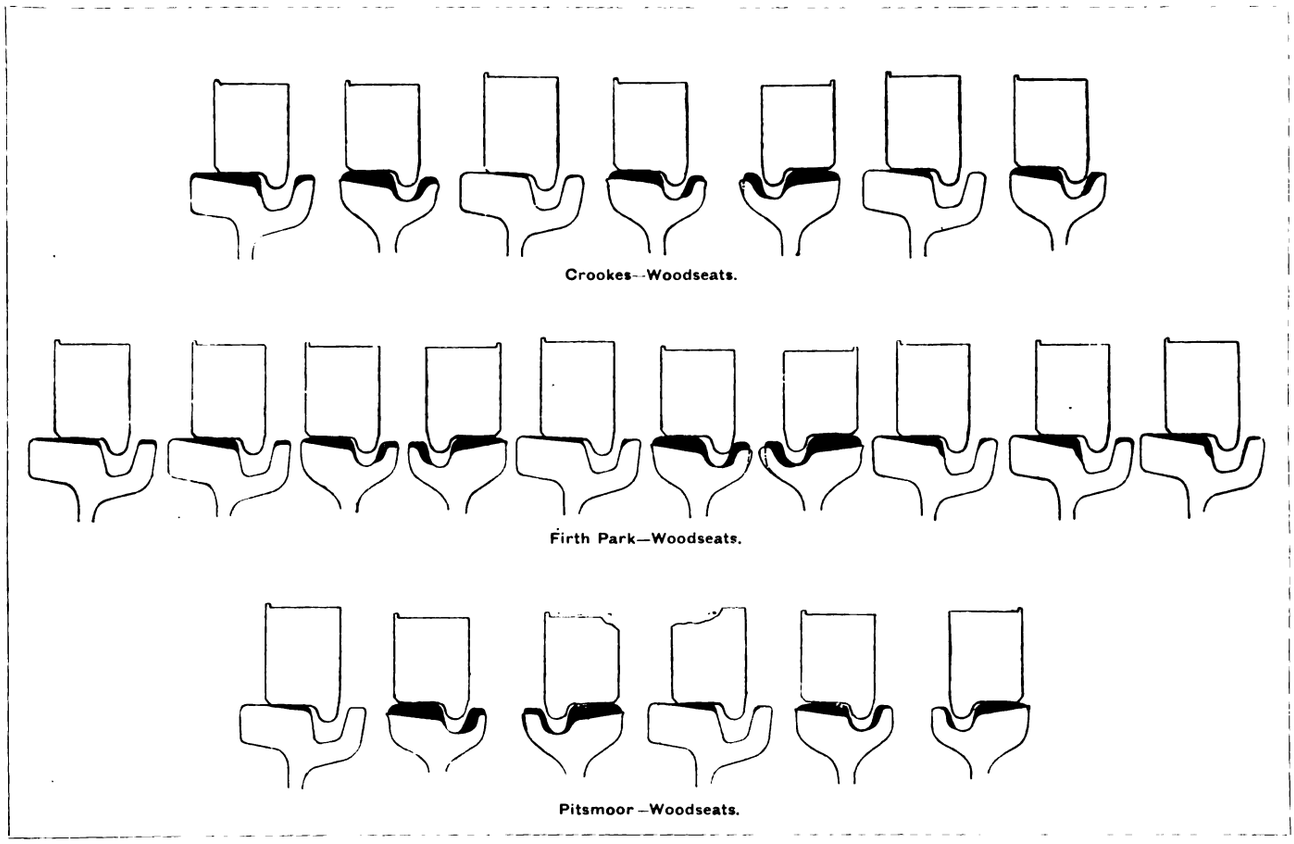


Fig. 9.
Track Wear—Sheffield Corporation Tramways.

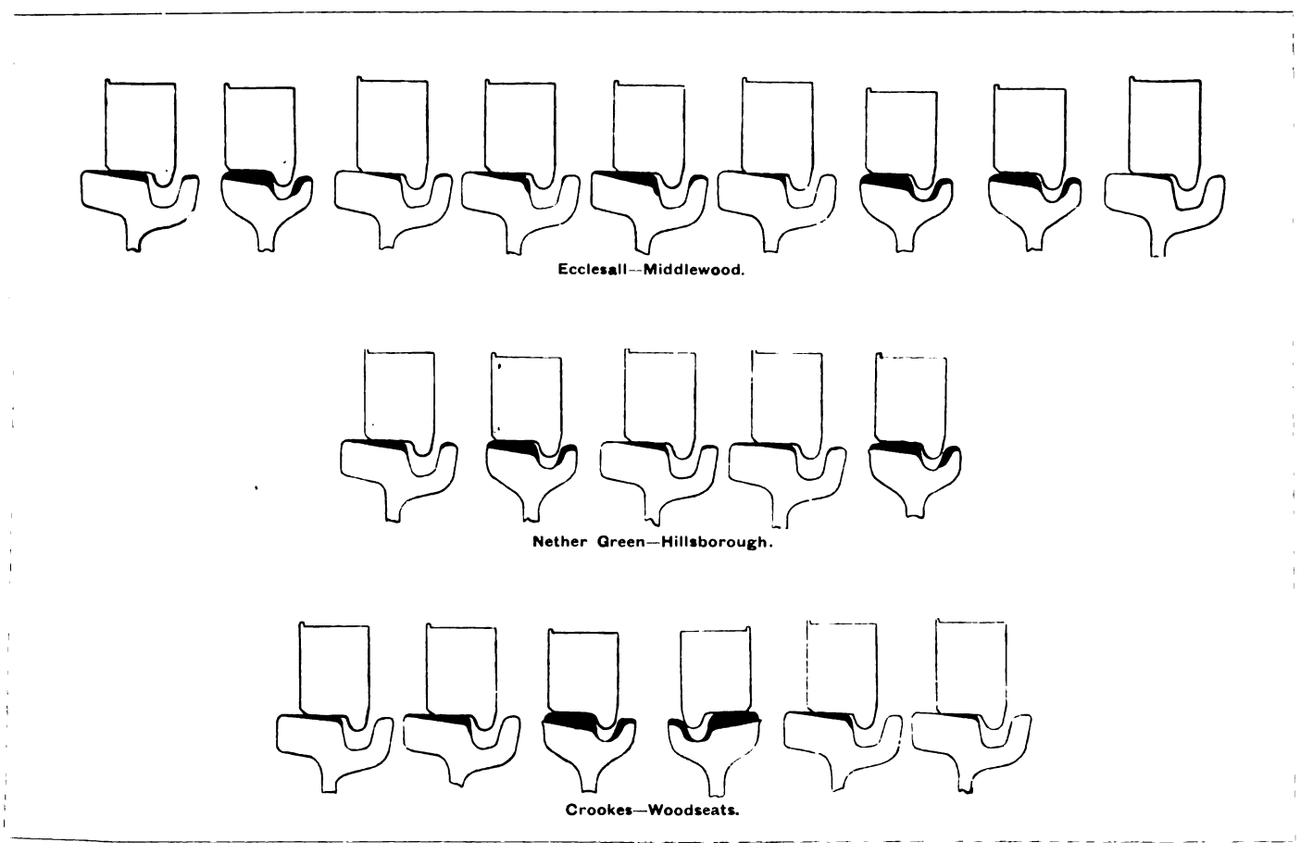


Fig. 10.
Track Wear—Sheffield Corporation Tramways.

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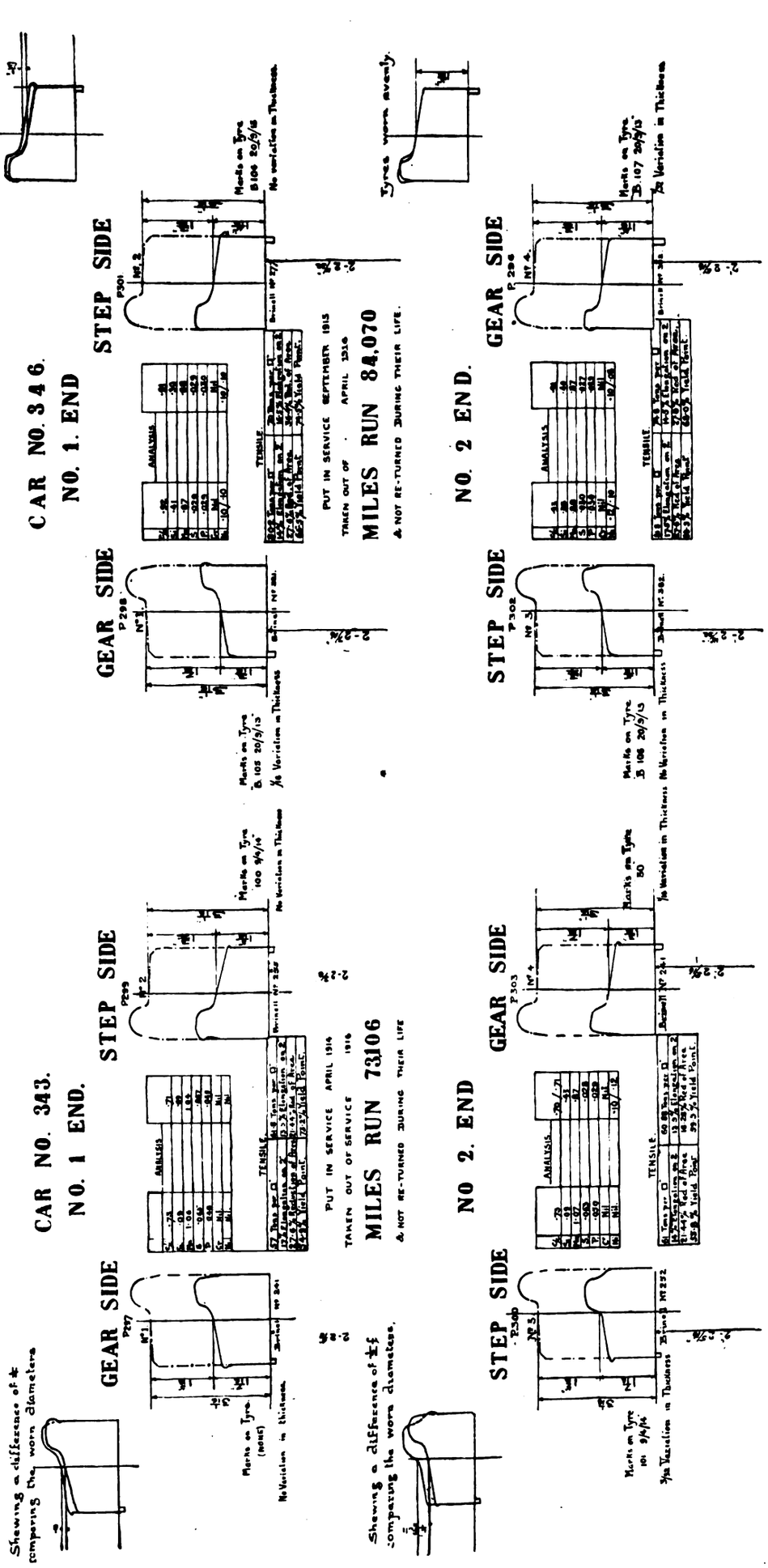


Fig. 11.

Sheffield Corporation Tramways—Tires run completely out without re-turning.

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(3) When the flange becomes more than 3-16th in. above or below the standard section of flange of the original tire.
(4) When the flange at its base is less than $\frac{7}{8}$ in.
(5) When the tread of the tire is worn with a considerable hollow.

In re-turning worn tires, it is not the general practice to re-form the profile to its original contour, as it is argued if this were done it would necessitate cutting too much valuable material away, which in turn would shorten the life of the tire.

It should be borne in mind, however, that the ratio of wear increases as the width of the flange decreases, but this point will be referred to again later.

### Outside Diameter Gauge.

For gauging the diameters of tires the gauge points should always be fixed at a certain distance from the outer face of the tire, as shown in Fig. 8. By this method absolute continuity in recording the wear of tires is obtained, as it is from the point thus obtained on the section that the profile of the worn tire is drawn, and the life due to wear recorded.

In certain cases, when calculating the mileage result, the amount of material cut away to re-form the flanges and to pair the tires is included with that which has been lost owing to wear. This method cannot altogether be described as satisfactory, as the actual loss due to wear should only be considered in arriving at the mileage results.

In this connection it may be well to emphasise the fact that when the diameter of one wheel is found to be wearing smaller than the other, it is better that such difference should be corrected as soon as possible, the flanges being re-formed to their original section at the same operation. When tackled in time the amount of material that is necessary to cut away from the body of the tire to re-form the profile is so very much less than would be the case when one wheel was, say, half an inch smaller in diameter than the other, and it is always well to bear in mind the adverse effect that such a pair of wheels must have on the track, etc.

### Reasons for Excessive Tire Wear.

Owing to a variety of causes the mileage results obtained on some systems are greatly superior to those obtained on others. Some of the conditions may be pointed out which have a decided adverse effect on tire wear :—

(1) Systems which operate in very hilly districts.
(2) Systems which operate in narrow streets, and where very sharp curves obtain.
(3) Narrow-gauge tracks.
(4) Single tracks with loops.
(5) Worn condition of tracks, and with special reference to the present time, the impossibility of effecting repairs to such tracks until after the war.
(6) Maintenance of car frames.
(7) Motors running against each other.

With reference to the condition of tracks, Figs. 9 and 10, prepared from information kindly supplied by Mr. Fearnley show a fair average of the actual wear that has taken place on the various routes indicated, the profiles being taken in July, 1916. It may be of interest to point out that the original section of the new tire when put into service had an inclination of 1 in 20, but after it had been in service some ten weeks the incline had become 1 in 6 !

### Lubrication of Rails where Sharp Curves Occur.

On certain systems in dry weather lubrication of the rails on sharp curves is effected by a liberal spraying of water, which should effect a considerable saving in flange wear, as the mud which is formed makes an effective lubricant.

### Differential Axle.

In Huddersfield a differential axle has been adopted for the purpose of preventing rail corrugation with very satisfactory results. In this connection, however, a report was issued by Mr. Wilkinson (The Tramway and Railway World, May, 1916), in which it was stated that the wear of tires had in no way been decreased, but as the trials had not been completed when the report was issued, the ultimate result should prove interesting, as one would naturally expect a longer life, especially as regards the flanges, with tires running under such conditions.

### Turning Cars.

It is also of importance to see that cars are turned frequently, so that they shall not always be running on the same rails.

### Maintenance of Car Frames.

The maintenance of the car frames, with special reference to the squaring of them, together with the wear of the axle-box guides, has a very considerable bearing on the question of tire wear, as owing to the flexibility of a car frame, and the difficulties of really efficient staying, the frames are very liable to get out of square, and are often helped in this direction by the too sudden application of the track brake.

The immediate result of this defect is to cause both excessive and uneven wear in the flanges and diameters of the tires, which latter eventually causes the tires to slip.

### Tires Run Through Their Life without Re-turning.

Fig. 11 shows two sets of car tires that have been run completely out without re-turning during their life. [The author here exhibited eight sections of tires.]

The mileage obtained from these two sets was 73,106 in the first case and 84,070 in the other, or, taking the worst-worn tire in each set, you get 4,873 miles per $\frac{1}{8}$ in. wear in the first case and 5,604 in the second. It may also be noted that in the case of Car No. 343, No. 2 end, there is a difference of $\frac{1}{2}$ in. in the diameter of one wheel as compared with the other, the result being that the smaller wheel has to travel $1\frac{1}{2}$ in. further than the large one at each revolution.

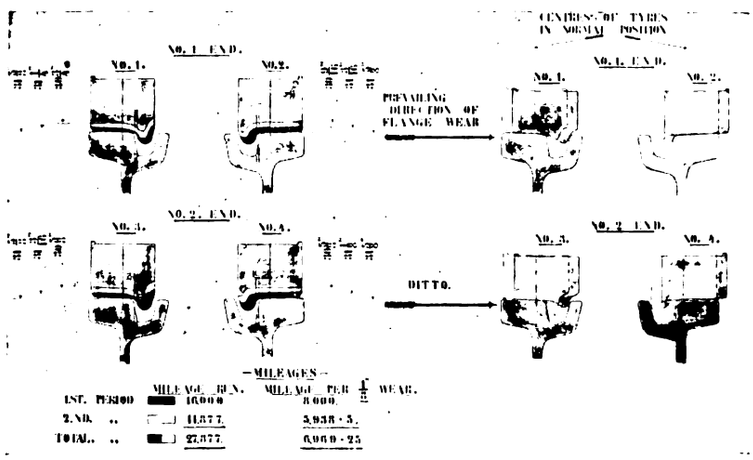


**Fig. 12.**

Glasgow Corporation Tramways Tire Wear—Car on Uddington and Paisley Route.

The difference has to be made up by continual slipping, thus causing excessive wear to both tire and rail, excessive consumption of current, to say nothing of our very old and esteemed friend, "rail corrugation." It therefore follows that the ratio of wear of the smaller tire is increased as its diameter decreases, with the added consequence of flange creeping, which again emphasises the importance of re-turning and pairing the tires more frequently during their life.

Two rather interesting examples of tire wear are shown in Figs. 12 and 13, which were taken from actual profiles of tires in service at Glasgow and Sheffield. It will be noted that in both cases the flanges of the tires have worn in the same direction, i.e., have crept towards the centre of the tire on one side of the car, whilst the flanges have followed on the other side of the car. This peculiarity of wear is in contra-distinction to that which obtains on flanges when the car frame is out of square, as the wear is then shown crosswise.

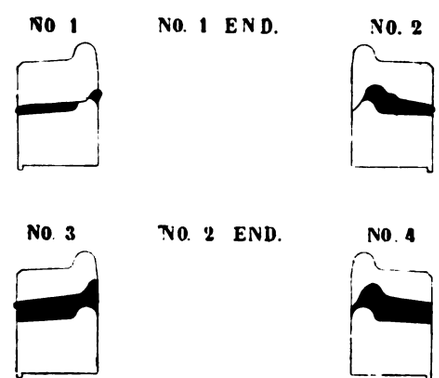


**Fig. 13.**

Sheffield Corporation Tramways Tire Wear—No. 2 end tires reduced $1\frac{1}{4}$ in. diameter so as to pair with No. 1 end tires on a mileage equivalent of 25,000.

When the tires shown in Fig. 12 are in normal position the worn diameter of No. 2 tire is 3-16th in. smaller than the worn diameter of No. 1 tire.

When No. 2 tire is hard up against the check of the rail the difference between the diameter of this tire as compared with No. 1 tire is still further accentuated, as No. 1 tire is forced over beyond its normal centre, and is consequently running on an increasing diameter, the throat of the flange being worn away as shown facilitates the travel of the tire sideways, until checked by No. 2 flange coming into contact with the check of its rail.

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It may be stated that the sections of the rails shown are the full original sections as rolled, so that if the worn rails are substituted, as shown in Fig. 14, a great deal more lateral movement actually takes place than is indicated on the diagram. When therefore the pair of wheels have got over to their extreme limit, i.e., when the flange of No. 2 tire has got hard up against the check of its rail, the relative positions of the wheels to the rail are liable to be frequently corrected, owing to the slipping that is taking place in the smaller wheel. Consequently every time this happens a sudden shock is inflicted on the outer face of No. 1 flange, coming, as it does, into violent conflict with the check of its rail, thus causing abnormal wear to the outside of its flange, with a corresponding increase of wear to the inside of No. 2 flange.

With reference to mileages obtained, it may be stated that the records of these tires are being very carefully noted, and for the first period run a mileage of 8,000 miles per $\frac{1}{8}$ in. radial wear was obtained, whereas for the second period an approximate wear of 6,000 miles per $\frac{1}{8}$ in. is shown, or a reduction of 25 per cent., due, no doubt, to the reduced width of the worn flanges, for, owing to the extreme shortage of labour, owing to war conditions, it was found impossible to turn the tires after the first period.

In Fig. 13 a set of Sheffield tires is shown having the same peculiarity as regards wear as illustrated in Fig. 12. In addition it may be pointed out that the tires of No. 1 end show a good deal more wear than those of No. 2 end, due possibly to the motors working against each other, and in this connection it would be rather interesting to know if any means have been adopted for synchronising the motors.

Unless the motors are working in unison the turning of all the four wheels to the same diameter appears, on the face of it, to be unnecessary. These tires were turned up to the new profiles shown, and in order that the wheels of No. 2 end should equal the diameters of No. 1 end, it meant a reduction of $1\frac{1}{4}$ in. in the diameter, or a loss of mileage equivalent to 25,000 miles.

### Double Drive.

Mr. Blackburn some few years ago introduced a double drive at Belfast (i.e., driving from both ends of the axle), with very satisfactory results. (The Tramway and Railway World, April 7, 1910.)

This considerably reduced tire wear on both tread and flanges, producing infinitely more even wear in both respects.

It would be of interest to hear the experience of others who may have adopted a similar arrangement.

### Limit of Wear.

The life of a tire is generally concluded when its thickness is reduced to $\frac{3}{4}$ in. or $\frac{7}{8}$ in., although there are cases on record where that limit is exceeded, e.g., a pony tire was run until it had practically worn through, the thickness being about $\frac{1}{8}$ in. to 3-16th in.; and a driving tire down to 7-16th in.; but the flanges in both cases were wonderfully well maintained.

### Effect Produced by Application of Water Whilst the Tire is being Rolled.

A microsection of No. 4 tire, gear side, of Sheffield Corporation car No. 343 (Fig. 11), shows the alteration to the structure of the material that has taken place, owing to the action of the water applied to the tire whilst being rolled on the tire-mill. This application is necessary for the purpose of removing scale, and giving a perfectly smooth surface to the finished tire.

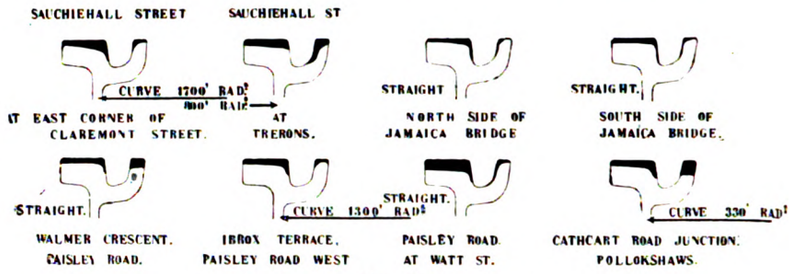



**Fig. 14.**

Glasgow Corporation Tramways—Sections showing wear on rails.

The two outer faces at each corner show the material immediately abutting those faces to be considerably refined, and the clear lines of demarcation shown in the structure take the distinct form of an ellipse. If the remaining two-thirds of the tire could have been examined the same formation would have been found, the reason being that the material cools off more rapidly at the corners, owing to the bigger area offered, than the centre of the tire, which retains its heat, and is consequently not affected by the action of the water.

The material is therefore much tougher on the outer faces, but had the tire been correctly treated the refined formation shown at the corners would have been obtained throughout, resulting in a uniform degree of structure and toughness.

The firm with which the author has the honour of being connected have carried out a considerable number of tests on tramway tires, rolled to the standard section, some of which were untreated, whilst others were subjected to a regular form of heat-treatment.

### Falling Weight Test.

The results of the falling weight tests obtained are set out in Fig. 16. The falling weight test, as specified by the London County Council, was adopted for the purposes of the test. This called for a weight of 1 ton, falling freely on the tire, placed in a running position, from a height of four feet, increasing by one foot at a time, until the required deflection of $1\frac{5}{8}$ in. (in the case of driving tires) was reached.

The analysis showed a carbon content of ·75, manganese 1·25, and silicon ·22. In Series 1 the heat-treated tires received the uniform average of nine blows, fracturing at the tenth in each case. Eighty-two foot-tons were expended on each tire, and the average deflection obtained was six inches. Regarding the untreated tires, an average of only 2·5 blows

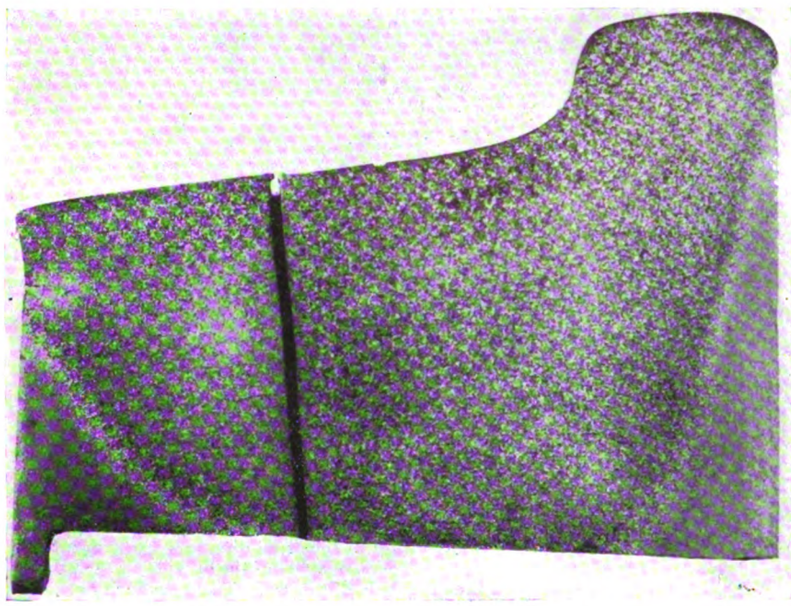
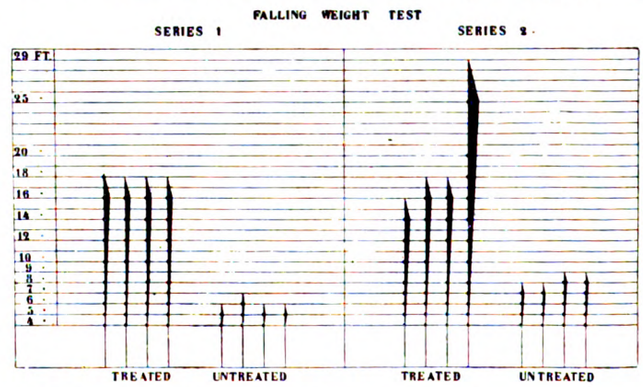


**Fig. 15.**

Sheffield Corporation Car Tire—Effect of application of water while tire is being rolled.




| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEFLECTIONS | 6½ | 5⅞ | 6 | 6 | | 13/16 | 12 | 3/4 | 13/16 | | | 4 13/16 | 5 3/8 | 5½ | 11 3/16 | | 1 3/8 | 1 3/16 | 2 1/8 | 2 5/8 |
| FOOT TONS | 82 | 82 | 82 | 82 | | 9 | 15 | 9 | 9 | | | 66 | 82 | 82 | 125 | | 22 | 22 | 30 | 30 |
| NO OF BLOWS | 9 | 9 | 9 | 9 | | 2 | 3 | 2 | 2 | | | 8 | 9 | 9 | 12 | | 4 | 4 | 5 | 5 |

**Fig. 16.**

Results of Falling Weight Test.

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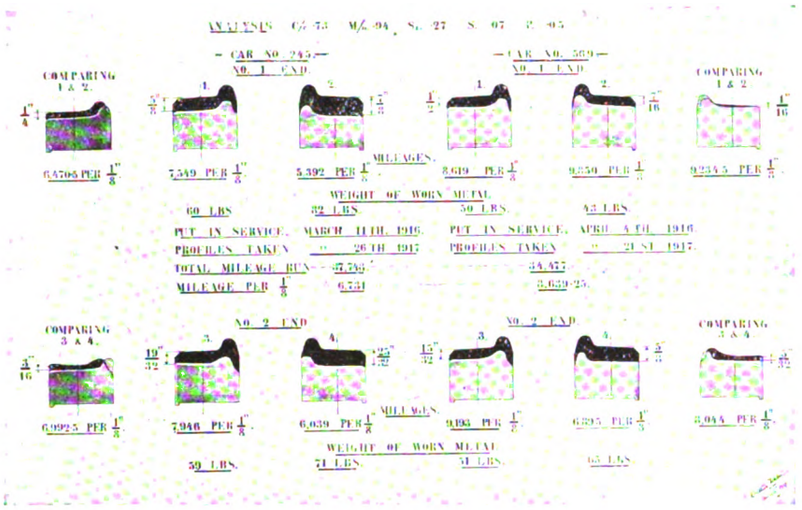


Fig. 17.

Glasgow Corporation Tramways (Uddingston and Paisley Route).—Running results of heat-treated tires.

was obtained, with 10·5 foot-tons, and an average deflection of just over $\frac{7}{8}$ in.

The average tensile tests are set out below :—

| | Maximum Stress. | Elongation on 2″ × ·564 | Yield Point Ratio % | Reduction of Area. |
|---|---|---|---|---|
| 4 treated tires ... | 60·2 tons ... | 17·8% ... | 69·4% ... | 33·8% |
| 4 untreated tires | 61·15 ,, ... | 6·6% ... | 62·9% ... | 7·1% |

In Series 2 the treated tires received an average of 9·5 blows, with 88·75 foot-tons, and yielded a deflection of $6\frac{3}{4}$ in., whilst the untreated tires received an average of 4·5 blows, with an expenditure of 26 foot-tons, and an average deflection of $1\frac{7}{8}$ in.

TENSILE RESULTS.

| Tires | Maximum Stress | Elongation on 2″ × ·564 | Yield Point Ratio % | Reduction of Area. |
|---|---|---|---|---|
| 4 treated | 60·2 tons | 17·8% | 69·3% | 31·7% |
| 4 untreated | 61·7 ,, | 6·2% | 57·6% | 6·2% |

TENSILE RESULTS.

It may be noted that, whilst the tonnage is slightly reduced in the case of the treated tires, the factor of safety is greatly increased by the improved elongation, yield point, and reduction of area obtained, in addition to which the wearing quality of the steel is greatly improved by the uniform and very much finer structure obtained.

LIMIT OF HARDNESS.

The degree of hardness in car tires is limited by the question of rail adhesion, which, in view of braking in hilly districts, is of vital importance. Fig. 17 shows the amount of wear that has taken place in two sets of car tires put into service at Glasgow. These tires were made of steel of an ordinary analysis, being afterwards subjected to careful heat-treatment.

The accompanying illustration, Fig. 18, shows the tires after being subjected to the following weight test, and are numbered 1, 2, and 3.

The London County Council test before described was adopted, with the following results :—

FALLING WEIGHT TEST.

| | Number of blows without fracturing. | Deflection. | Foot tons. | Remarks. |
|---|---|---|---|---|
| No. 1 ... | 10 ... | $4\frac{3}{16}$″ ... | 86 ... | Broke at 11th blow from height of 20 ft. |
| No. 2 ... | 14 ... | $8\frac{3}{8}$″ ... | 165 ... | Broke at 15th blow, the last two blows being delivered from a height of 30 ft. |
| No. 3 ... | 16 ... | $10\frac{1}{8}$″ ... | 193 ... | Unbroken, the last two blows being delivered from a height of 30 ft. |

TENSILE TESTS.

| | Maximum Stress. | Yield Point Ratio % | Elongation on 2″ × ·564. | Reduction of Area. |
|---|---|---|---|---|
| No. 1 ... | 68·8 tons ... | 66·2% ... | 15% ... | 27·6% |
| No. 2 ... | 62·8 ,, ... | 69·4% ... | 15·5% ... | 27·6% |
| No. 3 ... | 65·2 ,, ... | 69·3% ... | 16·5% ... | 33·5% |

The actual running results of these tires are exceedingly instructive, for whilst the mileages obtained per $\frac{1}{8}$ in. radial wear, viz., 6,731 in one case and 8,639 in the other, may be considered eminently satisfactory, under present conditions of running, the great disparity of wear shown issues big rations of food for thought!

In comparing the four pairs of tires it will be noted there is a difference of $\frac{1}{2}$ in., $\frac{3}{8}$ in., $\frac{1}{8}$ in., and 5-16th in. between the diameter of one wheel as compared with its fellow on the same axle, showing the greater disparity that exists the greater the wear, for while the average mileage obtained for the tires on No. 1 end of car No. 569 was 9,234·5 miles per $\frac{1}{8}$ in. radial wear, only 6,470·5 miles was obtained in respect of the tires on No. 1 end of car 245, whilst the difference in loss of weight of material is 49 lb., and it may be noted that both these sets of tires are in service on the same route.

Does not this fact again emphasise the great importance of more frequent turning of tires (that is, of course, when normal times come round again), when the diameters are found to be unequal, with the consequent reduction of the width of the flanges, when tires are run in that condition?

The grinding away of one tire by the other not only affects the question of the tires themselves, but also has a considerable bearing on the question of current consumption, wear to rails, including rail corrugation.

Referring to this latter, Mr. Stephen Sellon, in his excellent paper on "Rail Corrugation and Its Causes," read before the Institution of Civil Engineers in 1914 (Minutes of Proceedings, Vol. cxcvii.), referred to an estimate made by the Chief Officer of the City of

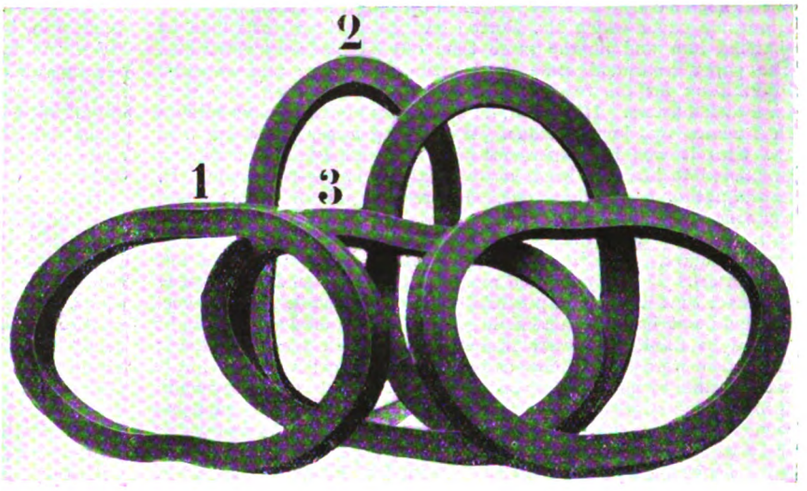


Fig. 18.

The Glasgow tires after being subjected to the falling weight test.

Glasgow Tramways that rail corrugation cost that undertaking at least £10,000 per annum, and other systems have no doubt heavy charges in the same direction.

There can be little doubt that the maintenance of the tire sections, flanges, and diameters should receive more frequent attention during

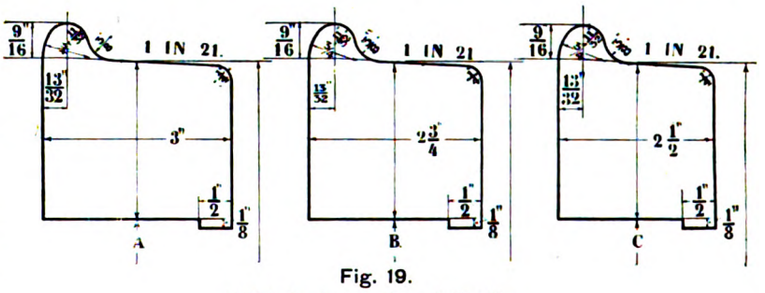


Fig. 19.

British Standard Sections—Rolled Sizes.

their life than at present appears to be the case, and this paper will not have been written in vain if by having drawn attention to this matter the practice is more generally insisted upon.

Admitting it may be necessary to cut away a little more material from the tread to re-form the flanges, with the consequent charges



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for labour, loss of material, etc., the other side of the account would be more than balanced by the reduction of rail wear, current consumption, and a helping hand to our old friend, "rail corrugation."

In 1915 a special committee of this association was appointed to consider the question of securing an adequate supply of tram tires in the difficult times we are living in, and, with this end in view, a meeting was arranged with the tire manufacturers. It was at once suggested that if the sections shown in Fig. 19 could be generally adopted it would greatly facilitate matters.

Our esteemed secretary, Mr. de Turckheim, who never lets the grass grow under his feet, at once got on the war path by circularising members, with very satisfactory results. Three different widths, viz., 3 in., 2¾ in., and 2½ in., were adopted, and it is pleasing to record that the standard section has been generally adopted, but if there are any managers who have not yet seen their way to adopt it, it can only be hoped they will give the matter their urgent consideration.

The question of standardisation as regards the wheel centres is, unfortunately, a more difficult one, owing to the fact that one has to deal with what is already actually existing, but with regard to new work the consideration of this most important question should not be lost sight of, as it would enable manufacturers to roll for stock, when immediate necessities could be supplied at once.

In conclusion, the author has very great pleasure in recording his gratitude to the following gentlemen for so readily granting information in connection with the preparation of the paper:—Mr. Fearnley, of Sheffield; Mr. Ferguson, of Glasgow; Mr. Blackburn, of Belfast, who also kindly supplied some of the slides; and last, but not least, his brilliant colleague, Mr. Harry Brearley, whose untiring research work in unfolding the very complex problems which are ever arising in the production of steel has made his name famous, not only in "Steelopolis," but also in the great steel world beyond.

### DISCUSSION.

Mr. A. Good (Sheffield) said he hoped that, being a tire maker, he would not be considered prejudiced in opening the debate upon the admirable paper which Mr. Norton had given them, for which he thanked him and at the same time offered his congratulations. The paper contained some most estimable advice and valuable information for the tramway managers and engineers, who were hard task masters. If allowed, he would also say that in his opinion that advice was long overdue. If anything appeared wrong with the tires it was his experience that the managers immediately proceeded to heave a brick at the maker's head—poor man. If, as the author had pointed out, one tire of a pair of wheels would wear more rapidly than the other, they were unequal in hardness; if a flat appeared there was a soft patch; if perchance one should burst, then they were condemned as a rotten lot. (Laughter). If that paper led members of the association seriously to reflect that it was just possible the crime might lie nearer home, it would not have been read in vain. For example, they might be led to think that their frames were not in true alignment; that there were such things as inefficient drivers; and also that it was possible to put the tires on too lightly. There were many small things which might produce the sad results. He hoped managers would be led by the paper to reflect on these lines. As one whose duty it was to endeavour to provide the best possible material he did not propose to criticise the paper; it was really above criticism. But there were one or two points to which he would like to draw attention. Mr. Norton had dealt with the subject of gauges and gauging and said, "It is very essential that the standard shrinkage allowance of 1/1,000th of the diameter of the wheel centre shall not be either above or below the limit fixed." It certainly should not be above one thousandth part of the diameter, that was, say, a 26-in. centre would give about $\frac{3}{32}$ in. That was ample. The smaller the nip they could put on their tires the better. One other point Mr. Norton made was as to cooling down, and he hoped the author would excuse him for saying that in his opinion he did not press the point sufficiently. Cooling down tires with water was a primitive method, and it was a dangerous method, especially if they were using the hard tires which were now being supplied by the best Sheffield makers. Cooling such tires down rapidly was certainly a very great danger to the tires, and it had an important effect on the hardness. Whatever might be their theories as to calescence, a tire cooled down in that way was a positive danger. He hoped that all those members of the association who had sprayers would go home and put them on the scrap heap. The few extra moments required to allow a tire to cool on to the centre under atmospheric conditions were negligible, and they would by that method save both money, time, and vexation.

Mr. H. Mozley (general manager, Burnley Corporation Tramways) submitted the following notes on tires:—The old railway rule for shrinkage was 1/64th in. for each foot of diameter, which is rather more than 1/1000th. We have had no trouble with our tires during the last 30 years. We had a lot of cast-steel wheels with curved spokes which fractured round the boss, but we did not attribute it to excessive shrinkage of tires. The method of heating tires is similar to ours, as also is the method of removing old tires. Our tires are not studded in. We discarded studding as being useless as a preventive in cases of loose tires; nor do we use a lip with the tire; they are simply bored straight through, the nip due to shrinkage being quite sufficient. In ordinary "pre-war" maintenance we ran a set of wheels an average mileage of 36,000 miles and then the car is due for general overhaul, when the wheels are turned up true and to equal diameters and they are then run to death, that is, till worn out, generally another 34,000 to 36,000 miles.

As to varying diameters, we do not find great differences in the two pairs of driving wheels on any one car. Generally speaking the two wheels on one axle will come out very closely of equal diameter, and the difference between the two ends of the car is not very great. A few examples are herewith given taken from our records as a general sample of our experience:—

No. 1 end axle. Wheel diameter = $30\frac{9}{16}$ in. and $30\frac{1}{2}$ in.
No. 2 end axle. Wheel diameter = $30\frac{7}{16}$ in. and $30\frac{1}{16}$ in.
Mileage = 35,773. New diameter = 32 in.
No. 1 end axle. Wheel diameter = $30\frac{7}{16}$ in. and $30\frac{3}{8}$ in.
No. 2 end axle. Wheel diameter = $30\frac{1}{4}$ in. and $30\frac{1}{4}$ in.
Mileage = 35,469. New diameter = 32 in.
No. 1 end axle. Wheel diameter = $30\frac{3}{16}$ in. and $30\frac{1}{4}$ in.
No. 2 end axle. Wheel diameter = $30\frac{3}{16}$ in. and $30\frac{1}{4}$ in.
Mileage = 40,126. New diameter = 32 in.
No. 1 end axle. Wheel diameter = $28\frac{5}{8}$ in. and $28\frac{1}{2}$ in.
No. 2 end axle. Wheel diameter = $28\frac{5}{8}$ in. and $28\frac{5}{8}$ in.
Mileage = 37,947. Turned-up tires diameter = $30\frac{7}{16}$ in.
No. 1 end axle. Wheel diameter = 29 in. and $28\frac{7}{8}$ in.
No. 2 end axle. Wheel diameter = $28\frac{7}{8}$ in. and 29 in.
Mileage = 35,033. Turned-up tires diameter = $30\frac{1}{2}$ in.
No. 1 end axle. Wheel diameter = $28\frac{3}{4}$ in. and $28\frac{5}{8}$ in.
No. 2 end axle. Wheel diameter = $28\frac{1}{2}$ in. and $28\frac{1}{2}$ in.
Mileage = 50,018. Turned-up tires diameter = $31\frac{1}{8}$ in.
No. 1 end axle. Wheel diameter = $29\frac{5}{8}$ in. and $29\frac{9}{16}$ in.
No. 2 end axle. Wheel diameter = $29\frac{11}{16}$ in. and $29\frac{3}{4}$ in.
Miles run = 69,895, wheels not turned up during total run. Diameter when new = 32 in.

Our tires are 2½ in. thick on the tread and we wear them down to about ¾ in. to ⅞ in. thick, when they generally show signs of coming loose. As to "tire wear," we have taken careful profile records covering a number of years to determine if there was any uniformity in flange creeping; but we met with nothing uniform. Our cars are all bogie cars, and we had at one time eight cars with Brill 27 G equal wheel trucks and four-motor equipments. These always come out with badly-shaped wheel flanges; they were sometimes so bad as almost to cut away the flange altogether.

The only four-wheel truck which we have is under the locomotive, and the wheels under this always come out perfect in form. The truck is, of course, very rigid and cannot spring. The wheel base is 5 ft. 6 in., weight 12 tons. We used the Brill maximum traction truck under our double-deck cars until about six years ago, and found flange creeping varied very much and seemed to have no relation to squareness of trucks or to the contour of road, all other conditions being equal in our case. Our profile record shows examples of all kinds of "creeping," but with no rule or system either with regard to wheel diameters or anything else. We now use our standard Burnley maximum traction truck on all types of cars, and although we have not entirely got rid of the trouble, the improvement is most marked, and very many sets of wheels come out almost as good in shape as they went in. We attribute this to the peculiar design of this truck. The driving wheels carry something like 90 per cent. of the total weight of the car, and the truck centre is directly over the centre of the driving wheel (not between the axles as is usual in bogie trucks). The pony wheels have little to do beyond steering the truck. This arrangement causes the driving wheels to place themselves as near truly radial to the curve as any device yet tried. The trucks are wonderfully easy under the car, and curves have no binding effect at all. If anyone is present from Birmingham, it would be interesting to hear their experience with this type of truck as to flange and tire wear generally.

Differential gear is mentioned. I think we may claim to be the first tramway to try differential gear, for as far back as 1907 we had a car fitted with it. Our experience was bad. Flanges of wheels wore out directly, and the life of the tires was short and merry, only 6,273 miles being got out of them. They had to be turned up after 2,569 miles run. We found that slipping was very much more common with this gear, as each wheel was independent, and if either sander failed to act the car could not start on heavy grades in greasy weather. The gear was used in connection with a radial bogie and was found to be of no benefit whatever.

We have noticed that if a season happens to be a very wet one, our tire wear is greater than during the dry periods. With regard to pony wheel tires, we get very long life owing to the light load on them. We also run them until they are practically worn away, say ¼ in. to ⅜ in. thick on the tread; the mileages will average about 100,000 to 110,000 miles.

We have a rather peculiar problem, however, which has so far not been solved. Occasionally a flat will develop on a pony tire which cannot be caused by skidding the wheels, as the brakes are so proportioned that the weight applied to them can never be sufficient to do this because the driving wheels will be skidded long before them. The flat is always on one wheel only, and further,

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this wheel is always smaller than its mate at the other end of the axle. There is no uniformity as to position under the car; that is, it may be on either side or at either end of the car, and on any route and under single or double-deck cars. Nor does it occur systematically under the same car or truck or on the same tire. They develop very rapidly, perhaps two days will suffice to make one a troublesome nuisance. Sometimes there will be two flats and on several occasions there have been a series of them so as to make the wheel corrugated all round, but in every instance the mate wheel has been perfectly free from the least suspicion of a flat. Nothing of this kind has been experienced with driving wheel tires. Why one wheel should wear quicker than its mate during one period of its life and not afterwards is a mystery. The trucks are all carefully tested for squareness on each overhaul. They are all very rigid and all carefully machined both for axle boxes and also where the cross-bars fit. The wheel base is 4 ft. in all cases; gauge 4 ft. The same fault was as bad with the old Brill maximum traction truck as with the truck we now use. It is not a question of "drive," as these wheels simply "roll." Its appearance is erratic; sometimes we have none for a year, then we shall have one or two cases, then at another period we shall have half a dozen cases simultaneously.

Our tires are all made to the same specification (both driving and pony). The specification is:—

| | |
|---|---|
| Carbon ... ... ... ... | ·69 |
| Silicon ... ... ... ... ... | ·34 to ·40 |
| Sulphur ... ... ... ... ... | ·04 |
| Phosphorus ... ... ... ... | ·04 |
| Manganese ... ... ... ... | ·70 to ·80 |
| Nickel ... ... ... ... ... | ·23 |

Tensile test, 54 tons.

As to synchronising the motor, I cannot see how this can be adopted with success in tramway working. Armatures fail and are replaced by others. The same applies to field coils. These changes are constantly being made, and the different parts are constantly being mixed up, especially in a large system, which has to keep a heavy service going with a minimum of spare cars.

Mr. W. Worby Beaumont (London) said the first speaker had referred to the experiments described in the paper on heating and expansion. These had first directed his own attention to it. Perhaps the measurements on the heated tires were made under some difficulty and inconvenience owing to the high temperature to which the observer had been subjected. He had made a few calculations based on the figures given, so as to compare the expansion at different ranges of temperature. Assuming a normal 62 deg., he obtained a co-efficient of dilation which at 200 deg. C. gave 0·00000458 per deg. Fahr. That co-efficient was lower than found by any other investigators. The same might be said of the co-efficients deducible for the whole range of temperatures up to 600 deg. The co-efficients of lineal expansion, according to the author's results, were as follows per degree Fahrenheit:—

| Expansion. | Temperature. | Co-efficient of Expansion. |
|---|---|---|
| $\frac{3}{64}$ in. ... | 220 C. ... | 0·00000458 |
| $\frac{1}{16}$ in. ... | 250 C. ... | 0·00000522 |
| $\frac{1}{8}$ in. ... | 400 C. ... | 0·00000635 |
| $\frac{5}{32}$ in. full ... | 500 C. ... | 0·00000623 |
| $\frac{3}{16}$ in. ... | 600 C. ... | 0·00000629 |

These figures show clearly the discrepancies in the temperatures or the measurements. For example, in the first two measurements, with a difference of 30 C., a dimension is given which is far too large. This is shown by the next pair, where there is a difference of 150 C., the expansion is only increased as 1 to 1·7 with a temperature range of 1 to 5. It is also to be noted that the expansion, according to the figures, decreases with the rise in temperature of 200 C. Either the smaller measurements given were wrong or the temperatures were wrong.

Coming to another part of the paper, he was encouraged to think that flats on the square wheels one sometimes heard on tramlines bore some relation to tires that had been allowed to wear so much that there was a difference of as much as ½ in. between the wheels running on one axle. Now it might be difficult to get work done in war time, but if wheels with half an inch difference in diameter on one axle were in common use, they ought not to be surprised if they got a great deal of grinding of the rails and flats on the wheels. That difference meant that the wheels had to skid a mile out of every 57 miles run.

Finally, Mr. Worby Beaumont asked with reference to the "differential axle" what the author meant by "satisfactory results"? He had said they had been adopted with satisfactory results for the purpose of preventing rail corrugation. What experience had the author which supported this? From the many diagrams exhibited that evening it was clear that there was plenty of work for men when the war was over, both on the permanent way and in placing wheels at proper distances apart from their axles, so that the treads did not run on the checks and the flanges on the treads, as appeared from what had been shown on the screen.

Mr. A. R. Fearnley (general manager, Sheffield Corporation Tramways), adding his thanks to those of the other speakers for the useful paper, pointed out that it should be recognised that Mr. Norton had approached the matter from the point of view of the manufacturer who was anxious to assist the users in obtaining the best possible results from the material supplied to them. They would all appreciate his efforts in that direction, and welcome the suggestions as to the best way of arriving at improvements in their methods of working. The diagrams exhibited on the screen proved that there were at least two tramways in the country which were not afraid to show the worst results they obtained instead of (as was generally done) making public only the best results. At the same time the diagrams suggested to those acquainted with the details of the particular systems that every care should be taken before a standard section of rail was decided upon. A good deal of the trouble so clearly shown up on the screen was, referring to Sheffield tires, due to a poor section of rail which was put down 17 years ago, a large quantity of which unfortunately was still in use, and compelled the adoption of the narrow tire with $1\frac{11}{16}$-in. tread.

In regard to the paragraph on pairing of tires, there was considerable difference of opinion amongst rolling stock engineers on this question, but the tendency to-day seemed to be in favour of turning up all tires before putting them into service, it being found that as rolled they were not sufficiently true or round to warrant them being paired in the way referred to in the paper. With respect to the gauges, he entirely agreed with Mr. Norton's views, and feared it was true that these gauges at times received rough usage. As to the removing of worn-out tires, heating in a gas-ring was not necessary; a couple of machine saws placed in proper position enabled the wheels and axle to be rolled under the saws, and old tires removed in a few minutes without the use of gas.

The most important part of the paper was that relating to the maintenance of the flanges. The points made by Mr. Norton were very important, and one could easily see which had a considerable amount of side-play without going far afield on any of our systems. The trouble in that direction was almost universal. The best method of dealing with it, however, was difficult to arrive at; as Mr. Good had said, they insisted upon their pound of flesh, or our 5,000 miles per ⅛-in. thickness. If they turned tires down to maintain even wheels and good flanges, they reduced the total mileage very seriously. Mr. Mozley had stated that four-wheeled cars were all wrong, and that bogie cars were all right, yet his final results in tire mileage were exactly the same as those shown on the screen. Mr. Norton had given a number of reasons for excessive tire wear, but there must be another reason which he had not yet found out. The mileage results of tires on cars working in similar districts and under very similar conditions varied as much as 20 per cent., and they had not yet been able to find a satisfactory reason for this. With regard to hard tires, they had already tried some of them, but up to the present had not succeeded in obtaining commensurate results.

Mr. W. E. Ireland (London County Council Tramways) said that he could confirm the author's views as to the desirability and advantage of pairing tires and mentioned that in the L.C.C. shops this had been the practice for several years. He did not, however, approve of the practice of putting tires into service unmachined on the treads, owing to the fact that only a very small percentage of tires have the rolls truly circular. With regard to the matter of heating tires for shrinking, he again agreed very fully with the remarks of the author, and mentioned that as a result of experiment and experience in the L.C.C. shops, the temperature was in most cases kept below 400 deg. Fahr. with good results; he also had given attention to the question of cooling and stated that in L.C.C. shops cooling by means of a water spray was dropped years ago. He agreed with Mr. Good's remarks that the short time required for tires to cool in the air sufficiently to enable the tires to nip the wheel centre would not justify the use of water on high tensile steel tires.

He appreciated the point made by Mr. Fearnley as to taking off tires, and mentioned that in the L.C.C. shops, tires are removed by being cut through with a hack saw and he thought this must be cheaper than using gas. He mentioned that the use of studs for fixing tires had been discarded in L.C.C. practice some years ago. The unequal wear of tires, as shown by the author's diagrams, he thought was the experience of most tramway operators and he knew, and probably they all knew, of cases of ½ in. difference of diameter of the two tires on one axle, although both tires had been made from the same cast. A great many troubles were primarily brought about owing to the wheels on the same axle being of different diameters, notably the excessive side rock and boxing of four-wheel cars. He had always been able to cure these troubles by re-turning the wheels to equal diameter and he agreed that it was desirable to re-turn wheels at as frequent intervals as is compatible with economy from a commercial point of view.

Referring to the gauges exhibited by the author he mentioned that similar gauges are in use in the L.C.C. shops and that to insure correctness and interchangeability limit gauges are used for the wheel centres, and tires bored to gauge in bulk are taken from the bulk, treated and shrunk on without trouble. He asked the author to say what he meant by "motors running against each other" as being a condition producing unequal wear of tires. The proper maintenance of truck frames was obviously most important, and

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in L.C.C. practice care is always taken to square the trucks whenever they are in the shops. There was one matter about which he did not think the author had made enough, namely, the value of oil and heat treatment of tires. He had made a number of experiments in this direction, and the results were very remarkable and indicated that a considerable improvement in the life of tires could be obtained as a result of such treatment. As an example, he mentioned the results obtained by test of specimens cut from two tires from the same cast and of similar analysis.

| Treatment. | Tensile Test. | | | Brinell Hardness Figure. | Abrasion Test. Grms. removed. |
|---|---|---|---|---|---|
| | Breaking Tons per sq. inch. | Reduction of Area. Per cent. | Elongation on 2 in. Per cent. | | |
| None ... ... ... | 55·35 | 18·4 | 12·0 | 192 | *2·14 |
| Heated to 1,500 deg. Fahr., dipped in oil 60 seconds, then allowed to cool in air (oil used, colza and rape seed) ... ... ... | 78·03 | 33·6 | 14·0 | 262 | *1·42 |

* Rate of travel, 1,200 ft. per minute. Total travel, 10,000 ft. Size of specimen, ½ in. × ½ in. × 1½ in.

He hoped that the question of heat treatment of tire steel would receive the attention it deserves as soon as working conditions permit and the opportunity presents itself.

Mr. R. H. WILKINSON (general manager, Huddersfield Corporation Tramways) thanked the association for the opportunity of being present and Mr. Norton for his instructive paper. He had been deeply interested in the question of tire wear. He would like to give them the result of his experiences with differential gears. He had fully expected to save repairs and also reduce the wear of the tires, though that was not the object of fitting the cars with those gears. He was surprised to find there was no saving in the wear of tires as against the ordinary gears. The difference only amounted to about 3,000 miles in the life of a tire. It was somewhat difficult to understand why that should be so. They worked a route of level track and it was all single. The results were not what he anticipated. Differential gears had brought to his notice that the flanges all wore out in the same manner. The author had suggested that studs should not be used to secure tires to the wheel centres. He did not use studs himself, but took the precautions of caulking over the inside. Huddersfield was not troubled with corrugation.

The PRESIDENT announced that Mr. Norton would reply to the discussion in the association's *Journal*.

## RETURN FARES.

Mr. A. V. MASON, M.I.E.E. (general manager and electrical engineer, South Metropolitan Electric Tramways and Lighting Company), in introducing the subject of "Return Fares" said :—

This is a heading, not a paper, but a few "potted" heresies to promote discussion.

For instance, the war has taught me many things—that women make excellent conductors, and that the average woman is quicker in taking fares than the average man ; that passengers unconciously connive at dishonesty apparently under the impression they save the girls trouble by saying "Don't worry about a ticket" ; that half fares for children are popular and remunerative. Another is that a lot of time can be saved and accidents avoided by collecting fares on the platform ; that return tickets are a convenience to passengers as well as to conductors, and that the same thing applies to weekly tickets. I am also of opinion that the odd halfpenny values on the 1½d., 2½d., and 3½d. tickets for single journeys can with advantage be discarded. It is true I have only flirted with these innovations during the war in a mild sort of way, but even flirting is instructive, and the experience is invaluable.

After the war receipts are bound to drop, but I rather think that expenses, certainly labour, will remain high (and the higher the better from the tramway point of view, that is, of course, if applied to other trades). Material will not drop to the pre-war price for a long time, and repairs will be heavy, as not only have the cars and tracks been overtaxed, but necessarily often neglected. The question, therefore, arises from the dividend aspect—Where is the money to come from ? From the ratepayer, the shareholder, or the public ? Undoubtedly from the latter.

Now, for sake of argument, every manager should say, "This tramway is my own private property, and I have certain fare restrictions. How can I make the largest net revenue ?"

The obvious remedy is to raise all fares to the statutory limits. This is all very well in theory, but is it expedient ?

As one method of expediency, if I personally owned a tramway with decreasing net revenues, I would experiment violently—curtail the 1d. fare to its statutory mile, divide this mile into four portions so that overlaps were frequent, and then issue single fares at the sums of the penny stages—no odd halfpenny values—and return journeys ; cheap return tickets would be issued for all fares above the penny. Here automatically the odd halfpenny values would reappear in the 3d. and 5d. returns. I think that I am correct in saying that 1d. fares are generally over 75 per cent. of all the fares taken, and in practice it will be found that the bulk of this traffic rides within the statutory limit of one mile, so that any suggestion of getting more out of the public must be fairly drastic. The chief grumble will come from the penny passenger, who is turned into a 3d. return, but the short distance penny passenger can nearly always travel his statutory mile by reason of the four overlaps. The B.E.T. have the credit for the four overlaps, and I believe the L.U.T. for the three. When we think in decimals the overlaps will be five to the 1d. stage.

The 2d., 3d., and 4d. fares would be the sum of the penny fares, but these passengers could always take return tickets at greatly reduced charges, especially to joy riders.

The fares would be :—

| | | | | |
|---|---|---|---|---|
| 1 mile | 1d. single. | No return | 1 mile | a penny. |
| 2 ,, | 2d. ,, | 3d. ,, | 1·3 | ,, |
| 3 ,, | 3d. ,, | 4d. ,, | 1·5 | ,, |
| 4 ,, | 4d. ,, | 6d. ,, | 1·5 to 1·65 | ,, |

By this means the passenger returning on the same day would get a reasonably cheap ride, on the basis that the further a man travels the cheaper should be his fare—expediently, for there is generally more competition in price and time. The operator would get the fare in advance, and the conductors and passenger would be saved trouble in giving and getting change and tickets.

Fraud there would be, but what of it ? If more money were brought in the system could stand a little peculation, which a few summonses would soon stop.

The next objection is method. The exchange ticket or overprints are self-condemned by their numerity, but the return ticket can be dated and cancelled by the punch. The punch loses its recording value, but this is less dangerous than exchanges, and the tickets are transferable, but why should they not be ? The L.C.C. have featured the return fare in another direction on many lines, I believe, with excellent results, and their method of cancelling the ticket with a separate punch seems to get over most of the abuses. This punch at the moment is the L.C.C. property, I believe.

We will now pass on to the workman. The workman is protected by the ½d. per mile, and the operator is bound to give a sufficient service of cars before 8 a.m. and after 5 p.m. The unfortunate voteless shop assistant or clerk has to pay full fare. The overtime man is not catered for at all, as workmen's facilities are often only provided at the time the works pour out between five and six o'clock.

Here again we get back to the return ticket bought any time before 8 a.m. and home by any car at any time. I would give the workman the concessions provided for in the Act for the single journey with a further concession for the return journeys, and nothing more, on the basis of twice the number of stages as the ordinary passenger, and any one would get the facilities that got up early enough.

We now pass on to the shop assistant and school marm, who should be provided for by cheap fares, and who can be dealt with by a weekly ticket—travel one way before 10 a.m. and home any time. The ticket is simple, but the punch register is destroyed unless clippers are used. I use clippers. Why ? Because my traffic staff still worship Baal. What we want is a passenger to be regular, wet or fine, and the weekly ticket provides this, being purchased soon after pay day before the weekly wage is spent.

What we want is some method to make the short distance passenger pay who only has the alternative of walking, and offer competitive attractive fares for the longer distance passengers and joy riders. Some may walk, it is true, but as I started I would run my tramway for cash and not for charity.

I put this forward as one means of getting, perhaps, some increased net revenue apart from a straight raising of fares.

Mr. C. D. STANLEY (general manager, New St. Helens and District Tramways) said he had only one suggestion to make on the paper, namely, the desirability of doing away with preferential fares, and especially the workmen's fares. It always seemed to him that tramway fares ought to be like other commodities ; the price of them ought to bear a definite relation to the cost. In his notes Mr. Mason had gone a certain distance in that direction, but said that they should give the same facilities as regards fares to anybody who got up early enough. It was difficult to see why getting up early should be an essential. It cost no more to carry at 9 o'clock than to carry at 6 o'clock. What they did now was to give a preferential rate to workmen, which in practice meant certain types of workmen. In at least one city the practice was to fix a fare for a certain distance and make every adult passenger pay it. As far as he could see the results of that policy were exceedingly satisfactory. He quite agreed with tramway operators giving all they could both to workmen and ordinary passengers for a penny, but preference was given to a certain class of person which was uncalled for, and in his experience it led to a great deal of resentment on the part of other passengers, who were not getting

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workmen's fares. They rightly asked why they should not have the same facilities, and it was a very difficult question to answer. He thought the time had come when the whole subject of preferential fares for the working classes should be reconsidered.

Mr. H. England (general manager, Yorkshire (West Riding) Electric Tramways), in criticising the paper, said he hoped Mr. Mason would take his remarks in the spirit in which they were made. He was quite aware Mr. Mason had written the paper with the object of creating discussion, and he had set out to invite criticism. In his view, Mr. Mason was entirely wrong in the opinions he had expressed; for instance, he said that women made excellent conductors. That might have been so in the early days when women were first employed, at which time women regarded it as a patriotic thing to undertake conductor's duties, but there had been a falling off, and the work was not nearly so well done now. There were many drawbacks to the employment of women as conductors, and he would much prefer to have the men back who previously did this work. That was, he thought, the general experience.

As regards return tickets, cheap fares for children, and similar concessions, mentioned in the paper, he totally disagreed that the granting of concessions of this kind was good for tramway revenue. In his opinion every passenger should pay the same fare for the distance travelled, and the business should be conducted entirely on an immediate cash basis, because return tickets, transfers, exchange tickets, and differential fares created loopholes for fraud, and there was really no reason whatever, in these days, why reductions on the ordinary fare charges should be made.

Mr. Mason had stated in his paper that if he personally owned a tramway with a decreasing net revenue he would experiment violently. This statement he did not agree with, because nobody was so conservative as a socialistic radical working man, and in the speaker's opinion to experiment violently with tram fares would be a great mistake. Before any change whatever was made in fares, the proposal should be very carefully considered indeed with the object of making as few changes as possible. To tinker with fares and alter fare stages for the purpose of experiment was a very hazardous procedure, and should not be undertaken unless there was a fair certainty that the change would be permanent. Mr. Mason had also said that after the war receipts were bound to drop. He did not agree with that view, because the general experience was that in all cases where increased receipts had been received, the tendency was for that increase to be maintained. It was quite true that none could forecast the future, but if high wages prevailed—as seemed likely would be the case—in the future, tramway revenue would undoubtedly benefit, and it was quite possible that the increases which had been obtained during the last two or three years would be maintained if not increased.

Mr. Stanley had stated in the discussion that he would like to see a revision of the workman's fare question. He was strongly of Mr. Stanley's opinion and really did not see why they should be compelled to carry workpeople earning very high wages at the rate of one halfpenny per mile. Reform in this direction, however, would probably mean Parliamentary intervention, and it was therefore hopeless at the present time.

Mr. G. W. Holford (general manager, Salford Corporation Tramways) heartily thanked Mr. Mason for his paper though he hardly agreed with most of his remarks and suggestions, and submitted that though "flirting" might be instructive it was sometimes dangerous. As to the suggestion to divide the 1d. stage into four portions, if they were going to do this they must have conductors who were able to collect fares. Mr. Mason had said there might be "fraud" and asked, "What of it?" He feared that it would be of a very extensive character. He might say that he had had experience of return tickets on a fairly large system. They abolished them and he hoped never to see them again. His suggestion was to abolish them and all similar concessions which had been given in the pay and bring in a cash payment for all fares on one basis. He hoped they might do that in a year or two. He quite agreed with Mr. England that he saw no reason why tramway receipts should go down after the war. It was quite surprising how well tramway receipts kept up. Why on earth they should go down when the men returned and there was a larger population likely to use the cars he entirely failed to understand. They all knew they would have a large expenditure to meet, but they hoped they could meet it with increased receipts. There was objection to some of the other concessions Mr. Mason suggested. Within the penny zone of a tramway system it was exceedingly difficult to increase revenue. What they were doing in most towns in the North was to shorten the stages. Some towns had reached the statutory limit allowed by Act of Parliament, and the Board of Trade had been approached to allow them to charge more than the rates already fixed, but so far they had been informed that it was altogether impossible at the present moment. So with the smaller authorities he failed to see how they could improve their position while the war was on. He did not think they would obtain satisfactory returns even if the suggested concessions were given. Mr. Mason thought they would be successful because they would be "popular." Well, he quite agreed that anything given to the public would be popular, but whenever they tried to increase fares it was unpopular. He hoped Mr. Mason would have successful results, but personally he would rather await those results than experiment himself.

Mr. R. J. Howley (joint manager, British Electric Traction Company) explained the present position of the negotiations which were taking place between the Council and the Board of Trade in regard to statutory fares. Several speakers had expressed the opinion that they did not expect any fall in revenue after the war. He thought that no one could say what the conditions were going to be after the war, but they hoped their revenue would be maintained. Everyone, however, agreed that expenses were going to be higher; wages had risen considerably and a great deal of that rise would continue after the war. The rise in wages would be reflected in the cost of materials, so that they must look forward not only to higher wages bills, but also to increased outlay on materials. There had been an increase in wages throughout the country, but he thought that the only industry which had been unable to meet that increased cost by a corresponding increase in the selling price of the commodity had been tramways. Tramways, as they knew, were limited by statute as regards the maximum fare which could be charged. In addition, many Acts of Parliament contained special fare restrictions which were statutory and could not be modified. It did not seem right that restrictions imposed in Acts of Parliament and Orders of the latter part of last century should be incapable of being varied when everything in the country was in a state of change owing to the war. The Council of the Association considered the whole question very thoroughly, and they decided to ask the Board of Trade to obtain from Parliament the power to review the maximum tolls and charges incorporated in the Acts and Orders, and if they thought fit, after such review, to vary them. An analagous case was the restriction on the maximum amount to be charged for electricity. In all recent Electricity Supply Acts and Orders provision was made for the Board of Trade to hear an appeal in regard to rates, and they had power if they thought fit to increase those rates. It seemed to him a reasonable request to ask for a similar form of appeal in regard to tramway fares. He did not think there were many cases where an appeal would have to be made, but at the same time it was most desirable that the machinery for such an appeal should be provided, and he hoped that the whole industry would support the representations of the association to the Government. At the present time the negotiations had got little further than the preliminary correspondence with the Board of Trade, but he thought that the conference would like to know the views of the Council on this important matter. (Hear, hear.)

## STANDARDISATION OF CONDITIONS OF LABOUR AND RATES OF PAY.

By E. H. Edwardes, A.M.I.E.E.

Mr. E. H. Edwardes, A.M.I.E.E. (manager and engineer, Lancashire United Tramways), submitted the following notes:—

In opening this discussion I am fully aware that it is surrounded by many difficulties; but I am of the opinion that if we unite our efforts these difficulties will be surmounted.

You all realise that the great question we shall have to deal with after the war is that of labour.

Labour long ago came to the conclusion that the best and most satisfactory method of dealing with conditions of labour and rates of pay is to become united. With that object in view, the present system of trade unions was formed, with the result that practically all the great trades in the country are now governed by trade unions and, we must agree, so far as the employees are concerned, with great success. Some of us are still, no doubt, averse to these systems, but I think we may safely say that amalgamation amongst workers has come to stay, whether we like it or not. What we now have to consider is the best and most businesslike method of dealing with the problem.

It must be admitted that the tramway industry throughout the country is most disjointed. Even the various negotiations with Government departments have to be carried through by the two Associations instead of one, which involves a considerable amount of overlapping. Further, each authority, without consultation with one another—even in cases where inter-running arrangements are in force—settles its own labour troubles independently, often with disastrous results, which are becoming more and more obvious every day. What I should like to put before you is the possibility of forming a united tramway federation to deal with these complex problems. There is nothing original in the idea, as it is already in force in most great industries in the country, and I see no reason why it should not be accomplished in the tramway industry, which is becoming more and more important every year.

It must not be assumed that the proposal is that a standard rate of wages should be established for the whole country; but that the country should be divided into areas, and the rates of wages fixed in such areas in accordance with the cost of living, etc., in such localities. This is the system adopted by such trades as engineering, building, etc.

Do not imagine that, by forming a united tramway federation, the object in view is to squash or oppose the various unions of workers,

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but simply to treat with them on a uniform basis and in a businesslike manner, in the same way in which they treat with us.

At recent arbitration proceedings before the Committee on Production a complaint was made by a representative of the men of the great variation in the conditions of labour for no apparent reason in various towns adjoining one another, and a remark was passed by the abritrator to the effect that it is a matter for regret that the tramway authorities do not work together in these matters; and I feel sure that if such a federation is formed by the tramway authorities it will be received with open arms by the Tramway Workers' Unions.

I should like to add that, at the suggestion of the Committee on Production, such a federation is in course of formation, the authorities in question comprising Lancashire and Cheshire Municipal Tramways, and practically all the undertakings in that area, including the companies, have promised to join; and a sub-committee has already been appointed, of which I am a member, to formulate a scheme, and I feel confident that the great majority of tramway undertakings throughout the remainder of the country would be equally pleased to join a central federation should one be formed.

I am simply putting forward these few brief points, on which I hope to enlarge when I open the discussion.

Mr. Edwardes proceeded to open the discussion. He said:—I am bringing before you a subject, not only of great importance, but of great urgency. It no doubt bristles with difficulties, but if we pull together I feel sure these difficulties can be overcome, for all realise that the great question we have to deal with now, and certainly will have to deal with after the war, is that of labour. Labour long ago came to the conclusion that the best and most satisfactory method of dealing with conditions of work and rates of pay is to become united. With this object in view, the present system of trade unions was formed, with the result that practically all the great trades in the country are now governed by trade unions and, we must agree, so far as the employees are concerned, with some success. Some of us are still, no doubt, averse from these systems, but I think we may safely say that amalgamation amongst workers has come to stay whether we like it or not. What I should like you to consider is the best and most businesslike method of dealing with these trade unions. I think it must be obvious to all that the one and only way is to become united ourselves. What have we now? Each undertaking is a little world of its own; each settles its own wages question, conditions of labour, etc., independently. The result is that rates of pay and conditions vary in nearly every instance without apparent reason, which all tends to make the men dissatisfied. This is most noticeable in cases where two tramway undertakings of similar size adjoin one another, and are closely allied through inter-running arrangements, but where the wages and conditions vary in many small details. Take, for instance, two tramways "A" and "B." "A" will pay a certain maximum rate and grant certain holidays with pay. "B" may pay a slightly lower rate, but grant more holidays than "A." A man leaves "A" to work for "B" and grumbles because his wages are less. A man leaves "B" to work for "A" and grumbles because his holiday period is reduced. Again, with regard to the question of allowance for signing on and off. One tramway might allow 20 minutes; another 30 minutes; and yet another 40 minutes. Further, on one tramway a man reaches the maximum rate of pay, say, in three years; on another tramway in four years; and on another tramway in five years. These are only a few of the many variations which, in my opinion, are entirely unnecessary.

What has been happening during the last twelve months? We all know there is in existence a Government Committee termed the "Committee on Production," and most of us have appeared before that Committee. Has that Committee come to stay? Personally, I think it has. I have lost count of the number of tramway arbitrations which have taken place before that Committee during the period referred to, but, as regards the group of Lancashire and Cheshire tramways, there have been three in a period of six months, and, at present, it looks as if there will be another shortly. Of these three arbitrations, one was in connection with an application for a general increase. An award was given to the men only. Number 2 was in respect to women workers. The women were granted an increase, no doubt owing to the fact that one of the tramways in Lancashire had already given their women employees an increase, and the arbitrator saw no reason why all the other twenty undertakings should not do the same. Number 3 was in respect to an application for a further general increase. An increase was granted during the present month, and we now understand that the men are very dissatisfied with the terms of the award because it has not come up to the award recently made in respect to the Birmingham district. Certainly one of these arbitrations would have been obviated if the undertakings had been united, and the existing dissatisfaction would also have been avoided. Many of us blame the Committee on Production because there appears to be no system in arriving at the awards; but can that Committee be blamed more than ourselves; and do you not consider that tramway undertakings would have been better off, and the men more contented, if the whole of the tramway industry had been united, and one joint arbitration taken to deal with the whole industry, instead of the present system of separate undertakings, or even separate groups of undertakings, approaching the Committee on Production? No useful purpose will be served, however, in reflecting on what is and what might have been.

What I should like you to consider is, what can be done without any further delay. The proposal I wish to put before you is the possibility of forming a united tramway federation to be controlled by one central committee, with district or area committees. It must not be assumed that the proposal is that a standard rate of wages should be established for the whole country; but that the country should be divided into areas, and the rates of wages fixed in such areas in accordance with the cost of living in such localities. I admit there is nothing original in this proposal, as it is the system which has been carried out with success in connection with our main industries in the kingdom, and I see no reason whatever why it should not be accomplished in the tramway industry, which is becoming more important every year. I also wish to make it quite clear that, in forming such a united tramway federation, the object in view is not to quash or oppose the various unions of workers, but simply to enable us to treat with them on a uniform basis, and in a businesslike manner, in the same way as they treat with us. There is, I regret to say, a drawback, as regards the tramway industry, in bringing forward a proposal such as this; and that is the fact that we have two associations instead of one. This must be perfectly obvious to anyone in the tramway industry, and more than noticeable by a Government department which, when approached in regard to any matter concerning the welfare of tramways generally, has first to meet one association and then the other, although the issue at stake might be identical in each case. If however you are of the opinion that it is too much at present to expect the two associations to amalgamate, I see no reason whatever why, for the sake of this wages question alone, a central committee should not be formed out of the two associations. I must point out here that, at the suggestion of the Committee on Production, such a federation is in course of formation, the authorities in question comprising 21 tramways in Lancashire and Cheshire. As far as I know, all the authorities have joined except one, which may, I think, be considered most satisfactory. These undertakings include both municipal and company tramways and a sub-committee has already been appointed to formulate a scheme; and I see no reason why it should not be possible to do in the remainder of the kingdom what has already been done in Lancashire. I should, however, like to point out that the benefits arising out of these federations would be greatly reduced if such federations are formed independently of each other without a central authority which, in my opinion, is absolutely essential. I have briefly outlined the subject, and earnestly trust that, after the discussion, a resolution will go forth from this Congress as to the advisability of forming such a United Tramway Federation.

Mr. G. W. Holford (general manager, Salford Corporation Tramways), in giving support to the paper, explained that he had been jointly interested with Mr. Edwardes in forming the federation referred to by him. Many conferences had been held between the Corporations and companies operating in Lancashire and Cheshire, and up to date those conferences had been most successful and had done excellent work, but they did not want it to go forth that such conferences or any other conferences of a similar character were being formed in antagonism to any trade or labour organisation. It was entirely in the interests of the industry generally they desired to work. It was not beneficial to either party that matters affecting wages and labour conditions should be settled simply between one little authority and one small branch of the unions, and then to find next week some different terms had been arranged in a neighbouring town, by which dissatisfaction arose and trouble was created. They desired to eliminate these troubles, not only in their own undertakings, but in others running into or through their systems. They felt sure that if areas were formed most of these differences would disappear. He believed such areas could easily be settled between representatives of tramway undertakings and of the employees' trade organisation.

He had been informed that the example of Lancashire and Cheshire had already been followed by Yorkshire and he hoped that it would not be long before similar organisations had been formed in the Midlands and the Southern Counties. Perhaps at the present time they could not progress so far as to have a central organisation. The Corporations and companies had often recently had occasion to appear before the Committee on Production, but he was pleased to say they had always been unanimous in the line of action to be pursued before the Committee and there was no real difference between them. It was most satisfactory and interesting to be associated with them all. They were now engaged in forming areas for the two counties concerned, so that they could have their scheme ready, as recommended by the Committee on Production, when the war is closed. He strongly urged that something of this kind was necessary to deal with labour troubles, which were among the greatest difficulties they had to face now, and would be so after the war. Some such system as that outlined had been adopted by the engineering trades and many other trade unions, and for the life of him he could not see why the same principles should not be applied to the tramway industry by arrangement between the

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tramwaymen's unions and the Corporations and companies concerned.

Mr. R. J. Howley (joint manager, British Electric Traction Company) remarked that on reading the paper the matter seemed to divide itself into two parts; one was the question of standards and conditions of work, the other the question of pay. It was quite within the scope of the association, he thought, to deal with the question of uniformity in such matters as working conditions, hours, allowances, expenses, and so on; but he was very doubtful whether it was right and proper for the association to deal with wages questions. It seemed to him that the first thing to be done was to standardise working conditions, and that was a matter which not only that association, but also he ventured to suggest their friends the Municipal Tramways Association might see their way to take up, the two bodies working together in the matter. As regards rates of pay, which must vary in different parts of the country, he thought that matter could best be dealt with by the local undertakings in each district coming together and forming a wages board.

Mr. H. L. White (manager and engineer, Great Grimsby Street Tramways Company) entirely agreed with Mr. Howley. Speaking from the company point of view, he had always felt it was desirable that there should be a closer connection between Corporation concerns and company concerns, but he feared it would be very difficult always to take joint action in such matters as rates of pay, although he thought it ought to be possible for all concerns to act more in unison so far as the working conditions were concerned. Therefore, whilst welcoming Mr. Edwardes' suggestion that there should be an endeavour made to secure uniformity of working conditions, he saw great difficulty in the way of members of this Congress supporting Mr. Edwardes in his advocacy of a federation of tramway undertakings to deal with the difficult problems of pay.

Mr. W. T. Robson (general manager, Southampton Corporation Tramways) said that he was intensely interested in Mr. Edwardes' paper, but still more interested in the remarks with which he introduced the subject to the Congress that afternoon. He fancied that Mr. Edwardes was looking ahead perhaps more than some of them realised, and he quite agreed with him that there were many difficulties in the way of getting a uniform rate of pay for England or the country as a whole. For instance, he had in mind three towns in the South of England where the rents were entirely different in each, the cost of living was quite different, and things generally were in each of those towns on an entirely different grade. But at the same time there was very much that might be said in favour of the scheme which Mr. Edwardes had suggested, and it was apparently being acted upon to some degree, or perhaps experimentally, at the present time in the Lancashire district. He wished it every success and at any rate he hoped the Council would be given an opportunity to go most thoroughly into the whole matter. He did not think that Mr. Edwardes went so far as to suggest that that meeting should put forward any proposition as regards standard rates of pay, but he certainly hoped the question would be referred to the Council for consideration.

Mr. E. H. Edwardes, replying to the discussion, said in reference to Mr. Howley's remarks that it was really a very difficult matter to separate conditions of labour and rates of wages, because in so many instances conditions of labour really was only a matter of wages. He failed to understand Mr. White's remarks, because in reading his paper he had distinctly emphasised the fact that he did not for a minute assume that the wages throughout the kingdom were going to be the same, but that they should vary according to the cost of living in each area. He again said that emphatically, but Mr. White seemed to think the proposal was that a small town in Lancashire should pay the same rates of wages as the London County Council. He was the last person to think that and he did not know where Mr. White got his idea from. Mr. White thought it absurd, but as already explained, there was no foundation for the criticism. He could not see that a federation of tramway undertakings was impracticable; the principle had been applied in other directions and to other industries, and what had been done with them could be done with tramways. All he had brought the subject up for was that it should be considered very seriously by the Council, and although, as he had admitted at the beginning, the proposals presented some difficulties, still he thought they could be got over. He hoped the Council would go into the matter thoroughly at the earliest possible moment.

## WOMEN DRIVERS.

By Archibald Robertson.

Mr. Archibald Robertson (manager, Greenock and Port of Glasgow Tramways) submitted the following:—

Brief résumé of the Greenock and Port Glasgow Tramways Company's experience of women drivers. Their conduct generally with special reference to time-keeping; qualifications for handling heavy cars in busy industrial centres; climatic conditions experienced in the West of Scotland; comparison with men drivers with regard to accidents; conduct in cases of sudden emergency; prospects of continuing to employ women as drivers in normal times.

Mr. Robertson then opened the discussion. He said:—I believe the Greenock and Port Glasgow Company was one of the first, if not actually the first, tramway company to experiment with women drivers and conductors. It will be readily understood that this was not from any desire to make a change, but from absolute necessity. On the outbreak of war a considerable proportion of our men at once enlisted, and as the various shipbuilding yards were very busy and paying high wages, men could not be got to fill the vacancies. A considerable proportion of our pre-war running staff were double-ended. Conductors who had qualified as drivers were at once put on to drive, and we set about training the men who had not already qualified as drivers, meanwhile filling up the vacancies on the back platform with selected women. As time went on more men left until we were faced with the alternative of putting on women drivers or drastically curtailing the service, and considering that about 70 to 75 per cent. of our traffic is munition workers' traffic, it will be readily agreed that stoppage or serious curtailment would have been disastrous. After very anxious and careful consideration, and I might add with considerable trepidation, it was decided to train a few selected women as drivers. The lady superintendent of the local labour exchange gave us valuable assistance in selecting the proper type, and after about four weeks' training the first batch of half a dozen was put on the road in charge of cars. The number was steadily added to until we had something like 80 per cent. of women on the running staff, that is, conductors, drivers, and checkers. Sixty-two per cent. of drivers were women. I do not know whether the military authorities in the north are more exacting in their demands than in the south, or whether our men volunteered more readily, but I know that but for the assistance of the women it would have been impossible to have maintained anything like a full car service.

The experiment of putting women on the front platforms was an immediate success. The first lot received perhaps a longer period of training than some of the later lots, and probably a little more attention than is usual in the cases of male drivers. After a month's training they were as efficient as good-class men with a similar period of training, and much superior to the class of men procurable nowadays. In Greenock, while we have no very steep hills, the cars are large 12-tonners, seating 74, the main streets are narrow, and congested vehicular traffic is heavy, and in parts the track is single with loops, so it says much for the capability of the girls that there is hardly an accident recorded against the first batch—certainly not a serious accident. I have a photograph of the main street taken last Saturday giving a slight impression of evening conditions. In the daytime it is, if anything, worse. The tramway system runs round the fringe of the town alongside the River and the Firth of Clyde. The larger proportion of the residential district is on the side of a somewhat steep hill away from the car track. The shipbuilding yards and other large works are alongside or near the track. The people from the residential districts find their way down to the main street which, particularly in the evening, has the appearance of a busy market square. Consequently to drive a heavy 12-ton car successfully requires both skill and nerve. I have already said that the first lot of drivers had a good record in regard to accidents, but this early good record has not been maintained in its entirety. Some of the later girls apparently think they have as good a right to have a "dunt" at a lorry as their male colleagues have. Some of the later lots of girls trained were as a whole hardly so satisfactory as the first lot, although many of them individually were quite as good.

We were somewhat concerned as to how the drivers would stand the winter. Greenock has a somewhat unenviable reputation in regard to rainfall, and storms are not unknown. The route is fully exposed to the gales which blow down the lochs branching off the firth. Here again I was agreeably surprised. While the "missed turns" were more frequent than during the summer, necessitating a larger duty sheet, the girls stood the cold remarkably well. Rain and snow did not daunt them; the only conditions which seemed to frighten them was a "greasy" rail. There were more failures to report on a mild morning when rails happened to be "greasy" than on wet and stormy mornings. With the object of making the fronts of the cars more comfortable, we had vestibules fixed, but they were not wanted, and in fact the girls preferred the cars without them. Arrangements were made under which the crews on the late long shifts during winter got a cup of tea and a biscuit between 7 and 10 p.m. This appeared to be appreciated. When it was suggested that the hours worked per week should be reduced, it was found that they preferred to work similar shifts to the men. They are paid by the hour, and you would be surprised to learn the hours worked by some. While the experience has generally been favourable, there are one or two points that occur to me where they are perhaps not so reliable as men. While some of them have not lost a single minute's time in the course of 12 months, a proportion of them do not realise the necessity for punctual reporting. They appear to think that if they report within 10 or 15 minutes of the reporting time there should be nothing to complain about, and even when they do not turn out for work they sometimes neglect to send word.

We experienced some slight trouble at the beginning of last winter. A munition factory employing many thousands of girls

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at good wages was started at a place within easy train reach of Greenock, and the novelty combined with the more congenial nature of the inside work during the winter appealed to our girls and many of the best of them easily got a start at munitions making. On the position being explained to the authorities, the practice of taking our girls was stopped, and most of them subsequently came back to us. To replace, at the time, the girls who went to the munition works we had hurriedly to engage and train others, and as good type girls were increasingly difficult to get, a few who perhaps would not in ordinary circumstances have been selected were taken on. Our experience is that employees should so far as possible be of a like class and that a good class. Unless good class girls be selected trouble is certain. I do not think that a girl is just as satisfactory in case of sudden emergency as a well-trained man. As a rule a large proportion of them are more "nervy," although there are cases when they have acted as coolly and efficiently as a man could. A sudden fright appears to take more out of them. I have known cases where a woman to avoid an accident has acted in every way absolutely correctly, stopped the car, and afterwards fainted away. In this connection it must be kept in mind that women drivers are a recent innovation, while the staff of male drivers is the product of years of training and practising (a few new ones being added occasionally), so that with men the right thing to do in every case is done almost automatically and without the necessity of thinking. In the case of women entirely new to the work this was at first not so, and in this respect they may be considered inferior to men, but with longer experience they have become more efficient, until now they are very little, if anything, inferior. You cannot, of course, put a large number of untrained women (or men, for that matter) to any work to which they have not been accustomed and have them as efficient in a few months as others who have been years at the work. One might just as well expect a crowd of female workers in engineering works to be as expert fitters as men who have served five or six years' apprenticeship.

The innovation was received well by the public, and the girls get on fairly well with the passengers. Much depends on the manner and disposition of the individual girl. It has been noted that the greatest grumblers are women, and that the male workers have been with few exceptions courteous and forbearing, especially when they are comparatively new to the work. Drivers are not brought into such close contact with the passengers as conductors, but bearing on the humour or tact displayed by the conductors I might mention an incident which actually occurred. A man and boy got on a car, and the man claimed that the boy was under 6. The conductress asked for his name and address. "What for?" said the man. "So that we can get his birth certificate and send it to the school authority," she quickly replied. The proper fare was at once paid. (Laughter.) In conclusion, I might say that in my opinion, so far as the running of the cars is concerned, these could generally be fairly efficiently worked by women, provided there is plenty of time given to train them properly and that the proper type is selected. It is advisable, however, that a proportion of the drivers be reliable men; this is to ensure assistance in case of accident. In training women drivers, it will probably be found necessary to reject a larger proportion than in the case of men, and, of course, some systems are more favourable for experiment than others. Work on a level track is easier. Considering that in three or four months 50 per cent. to 60 per cent. of drivers were replaced by women, who had until then never thought of working a car, the results have been wonderful. In Greenock we were fortunate in that the few male drivers over military age left with us were good and sensible men. They did their utmost to assist in training the women, so that munition workers' service could be maintained. Without the assistance of the men our difficulties would have been much greater. We have also a few women driving our big commercial omnibuses. This is a recent innovation (a couple of weeks), but they appear to be shaping all right. The following are our complete figures:—

Percentage of female drivers—Greenock 62 per cent., Rothesay 71 per cent., Coatbridge 33 per cent.

Percentage of total female running staff—Greenock 69 per cent. (76 per cent. leaving out spare time men), Rothesay 59 per cent., Coatbridge 54 per cent. (65 per cent. leaving out spare time men).

Maj. F. Coutts (general manager, Paisley and District Tramways Company) said that his experience was quite the opposite to that of Mr. Robertson. As conductors women were quite good, and they got along with them very well, but with women as drivers they had been rather unfortunate. They had made every effort to train them as drivers, because they were anxious that the army should have as many men as possible. They started to train 39; only 13 survived the training, and there were 26 who gave it up before the passing-out period arrived. Of the 13 who passed out as trained, he had only one left, so that a percentage of one out of 39 seemed to be their result. Perhaps their conditions were a little bit more difficult than those on Mr. Robertson's system. The grades were very heavy, and he thought that almost exclusively the trouble had been side strain. They had paid workmen's compensation to these girls for racked sides and so forth. He did not know how most systems were going on with this proposal to employ women drivers. Of course, they had been told that Glasgow had successfully trained them and he had recently made some inquiries and had a census taken at different points in the city, with the following interesting results:—

| Cars passed. | Women drivers. | Percentage. |
|---|---|---|
| 296 | 18 | 6 |
| 78 | 7 | 9 |
| 355 | 20 | 5·3 |
| 371 | 40 | 10·7 |
| 1,121 | 79 | 7 |

Adding the whole lot up, there would be an average of 8 per cent. Perhaps that was very good, but he did not think it was anything to make a noise about. If they only got 8 per cent. after two years, the war would have to last for 20 years before they got all the cars controlled by women.

Perhaps Paisley grades were against them. They had no magnetic track brakes and no protection in the front of the cars, whilst Glasgow was differently situated in these respects. Mr. Robertson had apparently been very successful in training them in Greenock; perhaps they had not to turn out so early there as on his system. On the Paisley system the traffic was heavy in the respect that during the workers' rush hours morning and evening, for an hour and a half they ran three times the number of cars that they did at any other time of the day. Thus a very large proportion of drivers had to turn out early, somewhere about 4.0 a.m. The traffic was almost exclusively for munition workers, and in that respect they were in a rather unique position. To expect the girls to turn out at a quarter to four on a wild winter morning was perhaps rather more than they could expect or had a right to expect. Taking everything into account, they did not turn out so badly at first, but later on as winter crept in they did not turn out nearly so well. The girls gave up the driving, and they were faced with the fact that they did this though they were getting 6s. 6d. more bonus for driving than conducting, and being in the North they could understand that would not have been given up lightly or without sufficient reason. They would think twice before they gave up such a good job, and therefore he was forced to the conclusion that they could not stand the strain and racking. Their success was too limited to justify them going any further with the scheme.

He would, however, like to know something about the position in regard to accidents. Girls were certainly liable to lose their heads, and would drop their hands on getting into a tight corner or a greasy rail. Sheer funk in the early morning at having to take out and operate a car on a greasy rail was a very serious matter when they had to carry 14,000 munition workers. Failure to negotiate a greasy road and thus to delay the traffic was a very serious matter. He did not think on balance there would be any saving in handing the men over to the army and asking girls to do work which really was beyond them. He did not think in the interests of the country they were justified in doing it any longer.

With regard to timekeeping, they had greatly improved this lately by a system of bonus; they originally paid so much bonus per week no matter whether a man worked three, four, five, or six days, but they found that had not the slightest effect. So they altered it. Now a driver got 10d. per day bonus if he or she worked four days per week, 1s. a day bonus if he worked five days and 2s. 2d. a day bonus if he worked six days. Now no one overslept in a morning or forgot to wind up the alarm as they used to do. A little money woke them up. As a substitute for girls he had tried to get boys. He was recommended by the Tribunal to get boys of 17 to 18. He did so and trained them, only to find that a new Order came out and they were called up just as they had finished training. He next tried boys of 16 to 17, and he scoured the North of Scotland for a week and came back with a net catch of five. So if anybody wanted boys they had better not go to Scotland for them. He thought these facts might have some useful bearing on the paper. Clearly they were not successful in training women drivers in all places; possibly with easy level tracks and suitable routes it might be different, but with him the scheme had been a total failure.

Mr. C. D. Stanley (general manager, New St. Helens and District Tramways) reminded the Congress that there was one other important point in connection with the employment of women as drivers, i.e., the labour difficulty. Some time ago he had been asked to train women to drive in order to release men, but the objections were not withdrawn. He agreed to undertake it if the Government would guarantee on their part that there should be no labour troubles owing to the men coming out. That guarantee had, he understood, not yet been given.

The Secretary (Mr. A. de Turckheim).—It applies to London.

Mr. Stanley said if he had put women on his cars the men would have come out at once.

Mr. H. P. Hogg said the question had been forced on them in one place in the north. They had very great diffidence in starting the women. The traffic was in a colliery district and was very rough. The men went into the towns on Saturday and when they came out they were very difficult to handle. However, they tried the women, who apparently were used to dealing with men drunk or sober, and as conductors they were a great success. They managed the men

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extremely well, and the cars were very crowded on Saturdays. It was quite surprising what they had been able to do, and when they first started they never believed it would be possible for women to cope with such traffic conditions. That was their experience, but they had not tried them for driving.

Mr. MASON said that if women were put on in London, every car would be run into the shed. The union said they were not going to have women drivers. They appeared to manage things differently in Scotland. Paisley tramways appeared to be able to do what they pleased. But he thought that tramway operators would have to consider the question of using women or else of shutting up. He thought that it was only a question of engineering skill to get over the difficulty of the strained side. It was practically a question of brake power, of doubling the leverage or in some way making the work less difficult for the women. Then the problem would only be one of the runaways downhill or in those places where women could not really drive the cars. Every tramway manager used to say that women conductors were absurd; now they could not get enough of them. It might possibly be the same with driving.

Mr. ROBERTSON briefly replied, and the conference then concluded.

## THE ASSOCIATION DINNER.

The annual dinner took place in the evening at the Trocadero Restaurant, and was, as in other years during the war, quite informal, without music, speeches, or toasts.

The Right Hon. Viscount Chilston (the president) occupied the chair, and the following were present :—

| | | |
|---|---|---|
| G. S. Albanese. | H. England. | A. C. Morrison. |
| R. Armitage, M.P. | A. R. Fearnley. | J. F. Moss. |
| O. H. Baldwin. | A. L. C. Fell. | H. Mozley. |
| Geo. Balfour. | F. A. K. Fergusson. | E. M. Munro. |
| J. Barnard. | E. H. Fleming. | Lee Murray. |
| E. Barralet. | W. E. Freir. | D. R. Myers. |
| J. Beckett. | Geo. Fry. | A. New. |
| H. R. Beken. | J. Fry. | A. Norton. |
| E. Benedict. | S. Garcke. | W. B. Pickering. |
| W. W. Beaumont. | Geo. Gerrish. | E. S. Quilliam. |
| C. Bickersteth. | J. B. Glenn. | H. B. Renwick. |
| H. E. Blain. | T. B. Goodyer. | A. Robertson. |
| F. Bland. | J. B. Hamilton. | W. T. Robson. |
| F. Bourne. | W. E. Hardy. | C. W. Rooke. |
| K. W. Brooks. | L. E. Harvey. | F. E. Saunders. |
| J. Browning. | R. J. Howley. | H. M. Sayers. |
| J. K. Bruce. | W. H. Hawley. | H. Scholey. |
| C. L. Buckley. | D. Hays. | S. Sellon. |
| I. Bulfin. | F. Hewer. | S. F. Shears. |
| C. D. Burnet. | G. W. Holford. | W. Shearer. |
| Major Burpee. | A. J. Hollington. | R. T. Simcock. |
| W. C. Burton. | L. A. Hunt. | L. Slattery. |
| F. Burfoot. | Jos. Hunter. | H. K. Spark. |
| Lieut. C. D. Bruce. | W. S. Hopking. | C. J. Spencer. |
| S. H. Callow. | F. Irvine. | M. O. Spicknall. |
| Lieut. B. T. Cameron. | Ald. W. Ivey. | Hon. A. Stanley, M.P. |
| John Cameron. | A. H. Jackson. | C. D. Stanley. |
| J. F. Cameron. | H. M. Jacob. | G. V. Stanley. |
| J. M. Cater. | A. Johnson. | H. M. Stevens. |
| A. W. Chambers. | J. J. Kelly. | C. G. Tegetmeier. |
| W. B. Cheyney. | B. Kingsford. | W. Thom. |
| Rt. Hon. Viscount Chilston. | C. J. Knight. | L. O. Thornbury. |
| A. W. A. Chivers. | E. H. Lean. | A. Toms. |
| Sir Fred Clarke. | S. A. Ledger. | H. E. Townell. |
| F. Coates. | H. W. Littler. | W. H. Twake. |
| T. W. Cole. | W. L. Lorkin. | —. Troughton. |
| —. Compton. | H. Lotery. | W. C. Ullmann. |
| H. P. Conibear. | U. McCabe. | W. W. Walkley. |
| A. T. Cooper. | A. McCallum. | A. H. Walton. |
| Lieut. R. W. T. Corbett. | W. L. Madgen. | H. L. White. |
| Major F. Coutts. | C. W. Mallins. | H. R. White. |
| A. Coveney. | H. Martin. | A. G. Whyte. |
| Harris F. Crookes. | A. V. Mason. | R. H. Wilkinson. |
| C. Davidson. | H. F. Maynard. | A. M. Wilcox. |
| A. de Turckheim. | Coun. R. Mayne. | H. L. Williams. |
| T. P. Easton. | J. C. Mitchell. | A. E. Wray. |
| E. H. Edwardes. | | W. Wyld. |

After dinner, on the proposal of the President, the toast of the King was duly honoured.

The Hon. Arthur Stanley, intervening in the *post prandial* conversation, remarked that although speeches and toasts were not on the programme, he thought all present would like to drink to the health of their president.

The President thanked them for the cordial reception he had received, and explained that he had intruded at their congress ("No!") that afternoon because he thought he would like to see more of the business side of the association. He certainly appreciated the papers that were read, and more than once he felt inclined to join in the discussions, but on the whole perhaps he acted more wisely by "sticking to his own last"—so he had remained silent in the chair. More than one of the topics had, however, attracted his attention, such as the conditions prevailing after the war and women tramcar drivers. He thought that after his visit to that afternoon's congress it was very probable that he would attend the next one, and if he did so he might be tempted to join in the discussion. He had certainly received the impression that there was a very businesslike side to the association. He fully sympathised with the managers present in the difficulties they must all have experienced in carrying on their business—difficulties which had been so largely increased by their staffs being called up for service in the war. However, he hoped that when the time came round for their next meeting they would find themselves in happier circumstances. But he could not shut out the thought that there would be serious difficulties to contend with even when the war was over, and it would be for their Council to try to devise wise methods for meeting those difficulties.

## ELECTRIC POWER SUPPLY COMMITTEE.

Mr. Roberts, for the Board of Trade, informed Mr. Gilbert in the House of Commons on June 25, that the members of the Departmental Committee on Electric Power Supply in England and the interests they represented were as follow :—Mr. F. Huth Jackson (chairman), Mr. J. Falconer, M.P., Sir Charles Parsons, Sir John Snell, and Sir James Devonshire (Electrical Trades Committee); Mr. John Kemp and Mr. C. H. Herz (Coal Conservation Sub-Committee of the Reconstruction Committee); Mr. J. F. Crowler (Irish interest); Alderman C. F. Spencer, of Halifax (local authorities owning supply undertakings); Mr. G. H. Hume (London County Council); Mr. A. J. Walter, K.C. (Ministry of Munitions); Mr. H. H. Law (Local Government Board); Mr. H. Booth (Board of Trade).

The chairman, Mr. Roberts added, had recently resigned on the advice of his doctor. The President of the Board of Trade was taking steps to appoint a new chairman, and also to increase the representation on the committee of local authorities owning electric supply undertakings.

In the end of June it was officially announced that Sir Archibald Williamson, Bart., M.P., had consented to act as chairman of the Committee in place of the Right Hon. F. Huth Jackson. The following representatives of local authorities owning electric supply undertakings were also added to the Committee :—Mr. W. B. Smith, Mr. Harold Dickinson, and Mr. E. F. Vesey Knox, K.C.

Sir Albert Stanley, President of the Board of Trade, replying to a question by Mr. Gilbert in the House of Commons on July 1, said that there were three members of the Committee who were directors of electric power supply companies. As to the three new members appointed to represent the interests of municipal undertakings, Mr. Harold Dickinson was the electrical engineer to the Corporation of Liverpool, and was nominated to serve on the Committee by the Association of Municipal Corporations; Mr. Vesey Knox, K.C., had acted as counsel for many urban district councils owning electricity undertakings, and was nominated by the Urban District Councils Association; and Mr. W. B. Smith was a member of the Glasgow Town Council, who owned the largest municipal electricity undertaking in Scotland, and was nominated by the Secretary for Scotland on the recommendation of the Lord Provost of Glasgow.

## BRITISH ELECTRIC TRACTION COMPANY.

The twenty-first ordinary general meeting of the British Electric Traction Company, Limited, was held on June 22 at the Holborn Restaurant, London, Mr. Emile Garcke, M.I.E.E. (the chairman), presiding.

The Acting Secretary (Mr. Thomas Bower) read the notice and the auditors' report.

The Chairman, in moving the adoption of the report, said that the stupendous expenditure by the nation and the employment of so many hands in the production of munitions of war, combined with restricted railway facilities, had had an effect upon the company's receipts akin to that which would be produced by great trade prosperity. The increased receipts, however, must be weighed against the increased expenses, and it was then seen that the balance of profits was not proportionate to the increased work done. The adverse conditions were both numerous and multiform. Prices generally, with the remarkable exception of tramway fares, had more than doubled since the beginning of the war, and were still rising. Wages had gone up considerably; taxation had increased; and restrictions on all forms of enterprise other than war work were enforced by all sorts of regulations, by dearth of labour and executive staffs, by prohibition against investment of capital other than for national purposes, and by feelings of uncertainty with regard to the future. The revenue account for the past year showed a revenue of £226,744 and an expenditure of £26,772, or a net profit of practically £200,000, which compared with £209,000 for the previous year. This reduction in net income was explained by a decrease in revenue of £17,000 and a decrease in debits of £8,000. This decline in revenue was due to the fact that, while the associated companies which had not done so well had reduced their dividends, some of those which had done better had not increased theirs, but it should not unduly depress them, because they knew it was the result of abnormal conditions arising out of the war. They were placing £15,000 to reserve (raising it to £425,000), paying dividends at the same rate as in the preceding year—6 per cent. on the preference stock and 3 per cent. on the ordinary stock—and carrying forward £97,598, compared with £86,428. At the end of 1915 the underlying companies—excluding the London companies—had total reserves of £1,300,000, and during the past year they had added £243,000, making a total of over £1,500,000, to which must be added the reserve and carry-forward of this company, amounting to a further £500,000. The investments stood at £4,285,000, an increase of £8,700 over the preceding year's figure. In War Loan and other Government securities this company and the associated companies held over £450,000, and the London companies a further £150,000. Referring to the question of tramway fares, the chairman

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said that, in view of the changed conditions, it was only equitable that the existing statutory restrictions should be reviewed by the Board of Trade or other Government department, and steps had been taken by the Tramways and Light Railways Association to have this question considered by the authorities. (Hear, hear.)

Having referred to the taxation on motor omnibuses (as reported in our motor traffic section), Mr. Garcke proceeded to express the hope that the Government would do something to remove some of the disabilities which restricted the best development of the electrical industry; and he urged that after the war it was imperative that this country should have a protected home market for its manufactures as a base from which, in conjunction with its colonies, it could keep a hold on international markets, and incidentally help to raise a part of the huge revenue which would be required for interest and redemption of war indebtedness. A continued policy of direct taxation to provide the major part of this revenue, as at present, would, he said, defeat its own object, for it would discourage the accumulation of capital, which was indispensable for new enterprise. From this point of view it was to be hoped that the excess profits tax would be withdrawn at the earliest possible date, for the excessiveness applied now to the tax rather than to the profits, and would deter enterprise and therefore check capital creation. With regard to the prospects of the associated companies, the view immediately before them was cloudy, but they saw a silver lining in the distance which bade them be of good cheer, for it indicated better times to come. (Applause.)

Mr. C. G. Tegetmeier seconded the motion, which was unanimously adopted.

## FINANCIAL REPORTS AND MEETINGS.

**Brazilian Traction, Light and Power Company** have declared a quarterly dividend of 1½ per cent. on the cumulative preference shares.

**Yorkshire (West Riding) Electric Tramways Company** have declared an interim dividend of 3 per cent., being at the rate of 6 per cent. per annum on the 6 per cent. cumulative preference shares for the half-year ending June 30, 1917.

**Dublin United Tramways.**—The directors propose to declare interim dividends for the half-year ended June 30, 1917, at the rate of 6 per cent. per annum, less income-tax, on the preference shares, and at the rate of 4 per cent. per annum, less income-tax, on the ordinary shares. The dividend warrants will be sent out on August 4.

**Rangoon Electric Tramway and Supply Company.** The gross profit for the year ended December 31, 1916, amounted to £68,653, including £57,817 receipts from the tramways and motor omnibuses. After making provision for all expenses, including depreciation and interest on debenture stock, there was a net profit of £22,199. Including the amount brought forward from last year, £2,783, and deducting preference dividend, there is a balance of £9,983. The directors recommend the payment of a dividend of 4 per cent. on the ordinary shares free of income-tax, leaving £2,903 to be carried forward.

**Colchester Corporation Tramways.**—The total revenue for the year ended March 31, 1917, was £15,933, the highest ever received, and an increase of £192 as compared with the previous year. The gross profit was £4,510, which is sufficient to pay interest and sinking fund, war bonuses and allowances, leaving a net profit of £24. The percentage of working expenses to receipts was 71·019, as compared with 67·79 in the previous year. There has been great difficulty in obtaining suitable motormen, and as a consequence many of the men have often worked seven days a week to maintain the services. No advantage has been obtained from the Government substitution scheme.

**Delhi Electric Tramways and Lighting Company, Limited.**—The report for the year ended December 31, 1916, shows that the receipts from the tramway undertaking were £11,135, and from the electric supply undertaking £22,934, being increases respectively of 16 per cent. and 13½ per cent. as compared with the previous year. The net revenue amounted to £11,593, and after deducting debenture interest, income-tax, and depreciation of plant and equipment, and including £895 brought forward from last year, there is a total available balance of £4,089. The directors propose to transfer £1,000 to renewals reserve account, to pay a dividend of 2 per cent. on the preferred share capital, and to carry forward £1,089. The amount of £4,000 has been charged to revenue to meet depreciation of plant and equipment, making the total reserve £10,000. A contract for a third Diesel engine has been made, and as it was impossible to obtain the necessary priority classification for a new dynamo, arrangements have been made to obtain an old machine locally.

**London and Suburban Traction Company.**—Presiding at the annual meeting, the Rt. Hon. Lord Stuart Wortley, chairman, said that their gross tramway receipts had increased during the year, but in the case of their omnibus companies there had been a falling off. The net receipts for 1916 were £1,306,335, a decrease of £3,600. The increase in expenditure more than swallowed up the increase in receipts, owing to bonuses to employees and the rise in the prices of materials. They had now to conform to an award given in May, under which for the year 1917 they would have to bear an additional charge for wages of about £17,000. The conditions caused by the war had seriously affected all the companies in which they were interested. In the case of the London United Tramways, for which a receiver had been appointed, it was, however, doubtful if the expectations of the net revenue, which were formed at the time of the amalgamation effected by the London and Suburban Traction Company, could have been realised. The cost of maintenance and repairs had been greater than was expected, and the elimination of competition had not been carried out to the extent anticipated. It was hoped that a better co-ordination of traffic facilities in Greater London would improve their results.

**Imperial Tramways Company.**—Presiding at the ordinary meeting of this Company in Bristol on June 27, Mr. Samuel White moved the adoption of the directors' report, and made feeling reference to the death of his brother, Sir George White, former chairman of the company. With regard to the Middlesbrough, Stockton, and Thornaby Tramways, though they carried more than half a million additional passengers, and their receipts exceeded £70,000 for the first time, there had been a considerable increase in the working expenses, with the result that the net revenue was over £1,000 below that of the previous year. The greatest credit was due to Mr. Freshwater, their manager, for the excellent manner in which he had discharged his trying duties. The Corris Railway had suffered from the abnormal conditions of the times. They had begun to build up a tourist traffic, but that had been knocked on the head. Their income for the year was £23,073, of which £14,228 was derived from the working of the Middlesbrough undertaking and the balance from dividends upon their other investments. It was sufficient to enable them to pay the 6 per cent. dividend upon their preference shares, interest upon their debenture stock, a dividend of 2 per cent. upon the ordinary capital, and to carry forward £123 19s. 10d. to the next account. When they returned to normal times there was no reason why things should not improve and their business become extremely profitable. They could look forward with some degree of confidence to a better return upon their investments in the future. The report was adopted.

**London United Tramways, Limited.**—While the gross receipts for the year ended December 31, 1916, show a gain of £2,190 as compared with the previous year, owing to the additional cost of material and labour, expenses increased by £34,000. After adding the balance brought forward from last year, and deducting interest and all other charges and expenses, there is an adverse balance of £2,583. The directors anticipate that the results of operation in the current year will be even less favourable. Owing to these circumstances, and the fact that a large sum will be required for renewals and repairs, an application by a debenture stockholder for the appointment of a receiver had been granted, pending the preparation of a scheme for the reorganisation of the company's capital. A summary of the accounts for the past year and the two preceding years is appended:—

| | 1916. | 1915. | 1914. |
|---|---|---|---|
| Traffic receipts ... ... ... | £322,171 | £318,341 | £316,838 |
| Advertising receipts ... ... | £6,000 | £4,731 | £5,957 |
| Rentals ... ... ... ... | £679 | £672 | £592 |
| Sundry receipts ... ... ... | £5,158 | £6,422 | £4,484 |
| Balance brought forward ... | £2,327 | £1,892 | £2,101 |
| Total receipts ... ... ... | £336,335 | £332,058 | £329,972 |
| Debit balance carried forward ... | £2,583 | — | — |
| | £338,918 | | |
| Power and running expenses ... | £155,405 | £132,501 | £140,304 |
| General expenses ... ... | £21,471 | £25,375 | £27,251 |
| Rents ... ... ... ... | £805 | £602 | £585 |
| National Insurance ... ... | £1,070 | £880 | £997 |
| To employees' benefit funds ... | £1,450 | £1,503 | £961 |
| Payments to local authorities ... | £10,592 | £10,767 | £9,964 |
| Repairs and maintenance ... | £77,473 | £62,628 | £60,484 |
| Reconstruction and renewals ... | — | £25,000 | £12,500 |
| Interest on loan ... ... ... | £4,655 | £4,478 | £2,787 |
| Interest on debenture stock ... | £65,997 | £65,997 | £65,997 |
| Balance to be appropriated— | | | |
| Pref. dividend at the rate of one-half per cent. ... ... | — | — | £6,250 |
| Balance carried forward ... | — | £2,327 | £1,892 |
| | £338,918 | £332,058 | £329,972 |
| Mileage open at December 31 ... | 53·5 | 53·5 | 53·5 |
| Number of passengers carried ... | 65,734,446 | 63,145,226 | 61,433,783 |
| Number of car-miles run ... | 7,494,898 | 7,744,894 | 8,996,891 |
| Average receipts per passenger | 1·17d. | 1·21d. | 1·17d. |
| Number of cars in stock ... | 338 | 338 | 338 |

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**Nottingham Corporation Tramways.**—The results for the year ended March 31, 1917, are, under existing conditions, very satisfactory. The annual report shows that there was an increase in the receipts of £7,762, compared with the previous year. The working expenses, however, show an increase of £17,450, the balance being £64,438, as compared with £74,125. The increase in car repairs of £6,422 includes six new car bodies. Owing to the impossibility of obtaining the necessary material, permanent way renewals have been practically at a standstill, and only £2,217 were expended thereon. Since the commencement of the war 305 men have joined the colours, and 12 of these men have fallen in action. Upwards of 100 men have also left the service for munition and other work. In the circumstances much difficulty has been experienced in meeting the traffic requirements. Details of income and expenditure for the past year compared with those of the four preceding years are appended :—

| Year ended March 31. | 1917. | 1916. | 1915. | 1914. | 1913. |
|---|---|---|---|---|---|
| Total revenue ... ... | £203,155 | £195,392 | £179,315 | £175,379 | £167,160 |
| Working expenses ... ... | 138,717 | 121,266 | 112,583 | 108,422 | 108,274 |
| Profit on working ... ... | £64,438 | £74,126 | £66,732 | £66,957 | £58,886 |
| Interest ... ... ... | £16,495 | £16,452 | £13,833 | £14,124 | £14,349 |
| Sinking Fund ... ... | 8,459 | 8,459 | 8,442 | 8,132 | 7,839 |
| Repayment of loans ... | 15,715 | 15,714 | 15,290 | 12,138 | 11 923 |
| Nottingham Corporation Bill | — | — | 502 | 550 | — |
| Net profit ... ... ... | £23,769 | £33,501 | £28,665 | £32,013 | £24,775 |
| Contributions to rates ... | £10,000 | £20,350 | £22,500 | £24,000 | £19,000 |
| Reserve fund ... ... | 13,769 | 13,151 | 6,165 | 8,013 | 5,775 |
| Passengers carried ... ... | 47,480,934 | 45,741,208 | 41,210,964 | 40,535,874 | 38,484,032 |
| Fare per passenger ... ... | 1·02d. | 1·01d. | 1·02d. | 1·02d. | 1·02d. |
| Car mileage ... ... ... | 3,766,411 | 3,885,322 | 3,789,857 | 3,543,669 | 3,485,789 |
| Units per car-mile ... ... | 1·70 | 1·64 | 1·53 | 1·51 | 1·65 |
| Power cost per car-mile ... | 2·39d. | 2·25d. | 1·91d. | 1·89d. | 2·06d. |
| Receipts per car-mile ... | 12·94d. | 12·06d. | 11·35d. | 11·87d. | 11·50d. |
| Expenses per car-mile ... | 8·44d. | 7·49d. | 7·13d. | 7·34d. | 7·45d. |
| Ratio of expenses ... ... | 68·28 | 62·10 | 62·78 | 61·82 | 64·77 |
| Total track mileage ... | 44·25 | 44·25 | 44·25 | 37·40 | 37·40 |
| Number of cars in stock ... | 155 | 155 | 155 | 135 | 135 |

**Metropolitan Electric Tramways, Limited.**—The report for the year ended December 31, 1916, shows that including the balance brought forward from 1915, and deducting all expenses chargeable to revenue, and a provision of £22,158 for future reconstruction and renewals, there remains a balance of £37,796, which the directors propose to appropriate as follows :—Reserve account, £11,015 ; dividend on preference shares, £25,000 ; balance carried forward, £1,781. The traffic receipts show an increase of £43,515 as compared with the previous year, but this increase is more than counterbalanced by the growth in working expenses. The number of units sold by the North Metropolitan Electric Power Supply Company has greatly increased owing to the supply to power users engaged in the manufacture of munitions. A summary of the accounts for the past year and the two previous years is appended :—

| | 1916. | 1915. | 1914. |
|---|---|---|---|
| Traffic receipts ... ... ... | £504,338 | £460,823 | £462,415 |
| Advertising receipts ... ... | £2,608 | £3,213 | £3,278 |
| Sundry receipts ... ... ... | £7,691 | £4,672 | £14,553 |
| Dividends and interest ... ... | £41,898 | £42,473 | £49,076 |
| Rentals ... ... ... ... | £2,330 | £2,380 | £2,265 |
| Balance brought forward ... | £1,532 | £1,118 | £1,052 |
| Total receipts ... ... ... | £560,397 | £514,679 | £532,639 |
| Power and running expenses ... | £232,226 | £212,376 | £229,665 |
| General expenses ... ... | £31,049 | £28,877 | £30,637 |
| Rents ... ... ... ... | £837 | £640 | £572 |
| National Insurance ... ... | £1,252 | £1,014 | £1,214 |
| To employees' benefit funds ... | £1,941 | £2,084 | £911 |
| Payment to local authorities ... | £96,994 | £95,503 | £100,663 |
| Repairs and maintenance ... | £91,258 | £61,750 | £65,795 |
| Reconstruction and renewals ... | £22,158 | £22,715 | £10,500 |
| Interest on loan ... ... ... | £6,720 | £6,602 | £5,512 |
| Interest on debenture stock ... | £38,166 | £38,843 | £39,565 |
| Balance to be appropriated— | | | |
| Preference dividend ... ... | £25,000 | £25,000 | £25,000 |
| Dividend on ordinary shares | Nil | £4,743(1%) | £9,487(2%) |
| Reserve account ... ... | £11,015 | £13,000 | £12,000 |
| Balance carried forward ... | £1,781 | £1,532 | £1,118 |
| | £560,397 | £514,679 | £532,639 |
| Mileage open at December 31 ... | 56·25 | 56·25 | 56·25 |
| Number of passengers carried ... | 105,109,403 | 89,656,054 | 93,325,170 |
| Number of car-miles run ... | 10,681,787 | 9,686,525 | 11,479,592 |
| Average receipts per passenger | 1·16d. | 1·23d. | 1·20d. |
| Number of cars in stock ... | 312 | 312 | 312 |

**Sheffield Corporation Tramways.**—The report for the year ended March 25, 1917, states that the maintenance of the services has caused a good deal of anxiety to the committee and management, who consider that they are fortunate in being able not only to maintain the services but to increase very largely the mileage on various routes. If the present rate of increase continues the number of passengers carried each day will shortly be equivalent to the total population of the city. In consequence of increased working expenses, the motor omnibus fares have been increased by approximately 25 per cent. A summary of the report for the past year, compared with those of the two preceding years, is appended :—

| | 1917. | 1916. | 1915. |
|---|---|---|---|
| Income— | | | |
| Traffic revenue ... ... | £519,281 | £449,946 | £391,535 |
| Sundry receipts ... ... | £6,404 | £5,663 | £4,341 |
| Total income ... ... ... | £525,685 | £455,609 | £395,876 |
| Expenditure— | | | |
| Traffic expenses ... ... | £155,088 | £132,399 | £120,296 |
| General expenses ... ... | £27,905 | £25,460 | £26,077 |
| Repairs account ... ... | £68,483 | £47,706 | £45,385 |
| Power expenses ... ... | £84,290 | £65,284 | £49,365 |
| Total working expenses ... | £335,766 | £270,939 | £241,123 |
| War allowances ... ... | £11,849 | £11,210 | £5,707 |
| | £347,615 | £282,149 | £246,830 |
| Gross profit ... ... ... | £178,070 | £173,460 | £149,046 |
| Interest and sinking fund ... | £64,742 | £63,818 | £73,540 |
| Income-tax on profits ... ... | £24,850 | £13,862 | £5,567 |
| Street improvements ... ... | £8,381 | £8,159 | £7,882 |
| Renewals fund ... ... ... | £34,698 | £30,115 | £30,018 |
| Surplus fund ... ... ... | £1,180 | £8,049 | £7,163 |
| Special purposes fund ... ... | £2,946 | £2,000 | £2,000 |
| Grant to Sheffield University ... | — | £5,000 | — |
| On capital account ... ... | £1,175 | £601 | — |
| Relief of rates ... ... ... | £40,098 | £41,856 | £22,876 |

**Glasgow Corporation Tramways.**—In the financial year ended May 31, 1917, the Glasgow tramways broke all records. As will be seen from the comparative abstract appended, the surplus to be handed over to the common good, which is the sum remaining after the payment of all charges and reserves, and may be regarded as the net profit, amounted to no less than £160,984, as compared with £43,548 in the previous year. This notable result has been obtained in spite of the fact that the payments to dependants of the men on active service and supplementary allowances have increased from £80,438 to £92,645. On the other hand, the traffic receipts show the very large expansion of £96,243 ; but against this there is an increase in expenses of £64,623. A notable item in the accounts is the growth in the income-tax, which has risen from £39,853 to £64,622, an increase of £24,769.

| Year ended May 31. | 1917. | 1916. | 1915. | 1914. |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Traffic receipts ... ... ... ... | 1,245,507 | 1,149,264 | 1,070,694 | 1,078,691 |
| Sundry receipts ... ... ... ... | 14,607 | 8,072 | 6,183 | 5,156 |
| Total revenue ... ... ... | 1,260,114 | 1,157,336 | £1,076,877 | 1,083,847 |
| Traffic expenses ... ... ... ... | 395,736 | 350,186 | 345,625 | 332,546 |
| General expenses ... ... ... ... | 137,816 | 144,297 | 142,020 | 134,034 |
| Maintenance and repairs ... ... ... | 143,758 | 133,659 | 144,530 | 156,214 |
| Power expenses ... ... ... ... | 67,231 | 64,346 | 51,995 | 53,483 |
| Clydebank bridges ... ... ... | 879 | 516 | — | — |
| | 745,420 | 693,004 | 684,170 | 676,277 |
| European War ... ... ... ... | 92,645 | 80,438 | 51,817 | — |
| Total expenditure ... ... ... | 838,065 | 773,442 | 735,987 | 676,277 |
| Balance carried to net revenue account | 422,049 | 383,894 | 340,890 | 407,570 |
| Dumbarton tramways ... ... ... | — | — | 126 | 180 |
| Interest on investments ... ... ... | 78,637 | 81,203 | 65,701 | 64,809 |
| Total ... ... ... ... ... | 500,686 | 465,097 | 406,717 | 472,559 |
| Deductions— | | | | |
| Rent of Paisley lines ... ... ... | 8,453 | 6,700 | 5,559 | 5,830 |
| Interest on capital ... ... ... | 78,846 | 90,474 | 78,797 | 82,921 |
| Sinking fund ... ... ... ... | 114,378 | 109,614 | 105,493 | 102,607 |
| Income-tax ... ... ... ... | 64,622 | 39,853 | 22,789 | 14,057 |
| Parliamentary expenses ... ... | 98 | 500 | 8,818 | 609 |
| Renewal and depreciation ... ... | 73,305 | 174,408 | 172,310 | 212,642 |
| Total ... ... ... ... ... | 339,702 | 421,549 | 393,766 | 418,666 |
| Surplus to common good ... ... | 160,984 | 43,548 | 12,951 | 53,893 |

The following are the traffic statistics for the year 1916-17 :—Average track mileage open (single), 196¼ ; car mileage, 25,786,047, increase, 822,738 ; traffic receipts, £1,245,508, increase, £96,243 ; traffic receipts per car-mile, 11·592d., increase, ·543d.; traffic receipts per passenger, ·769d.; increase, ·008d.; passengers, 388,294,876, increase, 25,923,412 ; passengers per car-mile, 15·059, increase, ·543.

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## CONTRACTS AND ORDERS.

**The Macintosh Cable Company's** tender for cable has been accepted by Salford Electricity Committee.

**The Vaughan Crane Company** have an order from Birmingham Corporation for an electric hoist at £3,095.

**Bruce, Peebles and Company, Limited,** are to supply a motor converter to the Woolwich Borough Council.

**The British Thomson-Houston Company** are supplying a turbo-exhauster to Birmingham Corporation at £1,696.

**A. Reyrolle and Company, Limited,** have an order from Sheffield Electricity Committee for 25 transformer protection sets.

**Willans and Robinson, Limited,** are to supply a 3,500 KW. turbo-alternator, with G.E.C. motors, to Poplar Electricity Committee.

**Cammell Laird and Company's** tender for car tires has been accepted by West Hartlepool Tramways Committee at 42s. 6d. per set.

**Edison Swan Electric Company** have a contract to supply a storage battery to the Public Works Department of Queensland, at £1,281.

**Brighton Lighting Committee** have placed an order with the Underfeed Stoker Company for three travelling grate mechanical stokers at £3,087.

**J. W. Courtenay, Limited,** Amberley House, Norfolk Street, London, W.C., have been re-appointed sole advertising contractors to Gloucester Corporation Tramways.

**The General Electric Company, Limited,** London, have been awarded a contract by the General Post Office for the supply of Osram lamps for the period ending March, 1918.

**British Insulated and Helsby Cables, Limited,** are to supply to Cardiff Corporation 2,815 yards of three-core cable at £1,400 per mile, 90 yards of armoured cable at £99 per mile, and 465 yards of l.t. four-core pilot cable at £159 per mile.

**Glasgow Tramways Committee** have placed contracts as follow :—P. R. Jackson and Company, commutators ; Carron Company, chilled iron and scrap-iron brake blocks ; British Westinghouse Company, armature coils ; and Cookson and Company, trolley cord.

**The British Westinghouse Company's** tender has been accepted by Salford Corporation for switchgear required at Irwell Park wharf, and h.t. switchgear in connection with cable to be laid to Trafford Park sub-station and Blackfriars sub-station. W. T. Glover and Company, Manchester, have received a contract for cable.

**Wolverhampton Council** have conditionally accepted a tender from Willans and Robinson, Limited, for a 5,000 KW. turbo-alternator set, with condensing plant and auxiliaries, steam motor-driven pump, piping and connections, and air filtering plant, at £22,690 ; and from the Stirling Boiler Company, Limited, for boiler plant at £24,687.

**Manchester Tramways Committee** have accepted the following tenders :—National Rail and Tramway Appliances Company, Limited, Liverpool, cast-iron brake blocks ; A. Pearce and Son, Sheffield, steel points and crossings, malleable cast-iron, light iron and wire ; Shelton Iron, Steel and Coal Company, Stoke-on-Trent, steel tongue points, steel castings, and gear case castings ; Thos. W. Ward, Limited, Sheffield, steel files, tool steel ; Marple and Gillott, Limited, Sheffield, steel springs, copper cable, and small gun metal and brass. Among the tenders accepted for the supply of stores for the electrical department for one year were the following :—Morgan Crucible Company, Limited, crucibles ; Bullers, Limited, insulators ; Doulton and Company, Limited, insulators ; W. T. Henley's Telegraph Works Company, Limited, and Charles Macintosh and Company, Limited, cables ; British Insulated and Helsby Cables, Limited, tubing and accessories ; Simplex Conduits, Limited, tubing.

**Formite Products.**—By an arrangement with the Damard Lacquer Company, Limited, of 98, Bradford Street, Birmingham, Messrs. Pinchin, Johnson and Company, Limited, of 26-27, Bevis Marks, St. Mary Axe, London, E.C., have been appointed the sole selling agency for Formite Products in Great Britain and certain Continental countries. All communications in reference to Formite Products should in future be addressed to Messrs. Pinchin, Johnson and Company, Limited, Insulating Varnish Department, 26-27, Bevis Marks, St. Mary Axe, London, E.C.

**Appeal to Local Authorities for Economy in Timber.**—Tramway managers and permanent way and borough engineers are affected by a circular which has been issued by the Local Government Board urging the need for reducing the consumption of timber. The Board urge that the use of timber for road works should be confined to repairs, that the relaying of wood paving should be deferred, and that where works for the improvement of road surfaces cannot be postponed, the authorities should adopt some alternative method such as surfacing with asphalte or other bituminous material, or taking up a section of sound wood paving, which could be replaced with setts, and using the blocks for repairing worn-out places.

## PERSONAL.

**Mr. William Murray,** tramways manager of Walthamstow, has been granted an increase in salary of £50 per annum.

**Mr. S. T. Allen,** electrical engineer of Wolverhampton, has been granted an increase in salary from £600 to £800 per annum.

**Mr. W. C. Bexon,** electrical engineer and tramways manager at Kilmarnock, has been granted an increase in salary of £100 per annum.

**Councillors W. Hakes** and **C. Raine** have been elected chairman and vice-chairman respectively of Hull Corporation Tramways Committee.

**Mr. J. R. Davison,** of Manchester, has been appointed mechanical engineer of Belfast central electricity station. He will take up his duties on July 24.

**Mr. H. P. Stokes,** electrical engineer and tramways manager to Bexley Urban District Council, has been granted an increase in salary of £100 per annum as from January 1, 1917.

**Glasgow Corporation** have granted increases in the salaries of the following officials :—Mr. T. W. Christall, claims superintendent, D. I. Laddell, outdoor traffic superintendent, £325 to £340.

**Mr. J. W. Burr,** borough electrical engineer of Swansea, with the consent of the Electricity Committee, is to give the Government authorities assistance in connection with the coal distribution scheme.

**Mr. G. H. Wightwick** has been appointed general manager of the Singapore Electric Tramways, Limited, in succession to Mr. J. H. Garratt. Mr. Wightwick has been in the employment of the company since 1905.

**Mr. A. S. Channon,** deputy electrical engineer of Grimsby, who has been in charge of the electricity station in the absence of Major W. A. Vignoles on active service, has been granted an additional bonus of £50 per annum.

**Mr. G. Roberts,** deputy engineer of Doncaster electricity and tramways undertaking, will take charge pending the Council's decision as to the rearrangement of work on Mr. Rayner's departure to accept an Admiralty position.

**Mr. J. G. Thomson** has been appointed boiler-house engineer at the Stuart Street station of the Manchester electricity department, in the place of Mr. J. R. Davison, who was recently appointed mechanical engineer of Belfast central electricity station.

**The King's Visit to Newcastle.**—Among those presented to the King and Queen during their visit to Newcastle on June 16 were Councillor R. Mayne, chairman of the Tramways Committee, and Mr. A. R. Sutherland, sheriff and vice-chairman of the Tramways Committee.

**Mr. W. C. Burton** was recently appointed a director of the London United Tramways, Limited, in succession to Sir Albert Stanley, who resigned in consequence of his appointment as President of the Board of Trade. **Mr. H. A. Vernet** was at the same time appointed an additional director.

**Mr. Theodore Eastaway Thomas** has been appointed development superintendent of the traffic branch of the London County Council tramways, at a salary of £800 a year. Mr. Thomas has for some time been commercial superintendent of the Metropolitan District Railway, the London General Omnibus Company, and the allied companies.

**Mr. S. E. Fedden,** general manager and engineer to the Sheffield Electric Supply Committee, has been voted an increase in salary of £100, to £1,000 per annum, with two further annual increments of £100 each. **Mr. H. E. Yerbury,** deputy general manager and engineer, has been granted an increase in salary of £100, to £700 per annum.

**Mr. H. Dickenson,** city electrical engineer, Liverpool, has been nominated by the Association of Municipal Corporations as a member of the Board of Trade Departmental Committee on Electric Power Supply. The nomination was made at the invitation of Sir Albert Stanley in order to meet the request for a larger representation of local authorities upon the committee.

**Mr. R. L. Horsfield,** tramways manager of Walsall Corporation, has been requested to give his services temporarily to the war staff of the Shipyard and Labour Department of the Admiralty, but the Tramways Committee are unable to accede to the request, being of opinion that Mr. Horsfield's services are indispensable to the tramway undertaking at the present time.

**Mr. J. H. Garratt** has resigned his position as general manager of the Singapore Electric Tramways, Limited, after an association of eleven years with the company. The chairman, Sir Frank A. Swettenham, at the meeting of the company on June 19, said that the directors hoped to be able on occasions to take advantage of his wide experience, both as a manager and an engineer.

**Mr. R. O. Baldwin,** of Bournemouth, has been appointed manager of Exeter Corporation Tramways at a salary of £300 a year, and took up his duties at the beginning of July. Mr. Baldwin has been traffic manager of the Bournemouth Corporation Tramways for some years past, and was previously in the service of the Bristol and the Doncaster tramways. Mr. H. C. Bartlett, manager of Exeter Corporation Tramways, has resigned his appointment.

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**Mr. K. H. Campbell,** borough engineer for Huddersfield, has received an honorarium of £500 for extra services rendered. Alderman Woodhead, in moving the payment, recounted extra work accomplished, including the conversion of the tramways at a cost of £258,556 for which he received no payment. He had also constructed four extensions outside the borough. Other towns not only engaged outside engineers to carry out such work, but had also remunerated their own engineers for the extra work thrown upon them. Alderman Wheatley challenged members to mention a tramways undertaking in Great Britain which had been constructed so cheaply.

**Mr. W. F. Bladon,** manager and engineer of the Barrow-in-Furness Tramways Company for the past twenty years, has received another important appointment under the British Electric Traction Company. The vacancy at Barrow has been filled by the appointment of **Mr. J. Dobson,** who has acted as assistant engineer and manager since October last, after serving the company in important positions in this country and abroad. During Mr. Bladon's service the tramways were converted from steam to electric traction. Before leaving Barrow Mr. Bladon was presented by the tramway employees with a gold watch. Mrs. Bladon received a satchel. Mr. W. H. Parsons, who drove the first steam car in Barrow in 1885, made the presentations, and Mr. J. Watson presided.

**Mr. F. Dudley Docker, C.B.,** was re-elected a director of the Metropolitan Carriage, Wagon, and Finance Company at the annual meeting. In proposing his re-election, Mr. J. F. Cay said the chairman was practically the founder of the Federation of British Industries. Every step he had taken had been not only to help the company but to assist the good-feeling among the workmen. In acknowledging the vote Mr. Docker said he was feeling the strain, and the time would come when they would have to find a successor. He testified to the valuable services rendered by everyone connected with the company. In his main speech the chairman referred to the formation of the Federation of British Industries, and said that to achieve complete prosperity for trade and commerce there must be united action through such a national association. Mr. Docker also mentioned the good work already achieved by the National Alliance of Employers and Employed.

**Mr. E. S. Rayner.**—The fatuity which sometimes dominates Town Councils with reference to their most capable officers is well illustrated in the case of Doncaster Corporation. On June 16 last we reported that Mr. E. S. Rayner, electrical engineer and tramway manager to the Council, had been granted an increase of salary. As a matter of fact, he had been recommended by the Tramways Committee for the increase, and in the ordinary way it was to be expected that the proposal of the Committee who best knew his work and capabilities would be ratified by the Council. But when the recommendation came before the latter body it led to much debate, and in the end the increase of salary was refused. Mr. Rayner has been able without delay to make the most appropriate reply. As mentioned recently, he has obtained an appointment under the Admiralty. To complete the picture, it remains to be said that the salary paid the Doncaster manager and engineer by the Corporation was £450 a year, and that the Admiralty are going to pay Mr. Rayner £700 a year. Mr. Rayner is to be congratulated, while the Town Council of Doncaster may be cheerfully left to struggle to find a new engineer and manager. In these days it is not easy to find good men, and if the Corporation get into difficulties they will have few sympathisers.

### WITH THE FORCES.

**Major W. A. Vignoles,** borough electrical engineer of Grimsby, who is on active service, has received the D.S.O.

**Lieut. J. R. Snell,** R.E., son of Sir John Snell, has been mentioned in despatches for exceptionally good work in the recent Soudan campaign.

**Lieutenant Francis Arthur Ellis,** Welsh Regiment, son of Mr. Arthur Ellis, city electrical engineer of Cardiff, has been severely wounded by a gas shell.

**Mr. J. K. Grant,** engineering assistant to the borough engineer of Birkenhead, has been appointed technical officer attached to a labour unit of the army.

**Mr. R. W. Kennedy,** late assistant editor of "Electrical Industries," has been promoted assistant inspector of the Aeronautical Inspection Department. On May 17 last he was gazetted temporary honorary lieutenant.

**Mr. R. Allen,** electrical engineer of Falkirk Corporation, has relinquished his appointment to join the Royal Naval College, Greenwich, to prepare himself for a commission in the Royal Naval Air Service.

**Mr. A. W. Robinson,** late publicity manager for Simplex Conduits, Limited, who has been serving as a gunner, in now undergoing a course of instruction at a cadet school prior to receiving a commission in the Garrison Artillery.

**Private C. S. Pickett,** 9th Battalion Royal Fusiliers, has been awarded the Military Medal for distinguished conduct in the field. Prior to joining the colours in November, 1915, he was engaged in the publicity department of Messrs. John I. Thornycroft and Company, Limited.

# TRAMWAY AND LIGHT RAILWAY NOTES.

## BATH.

A Track Paving Experiment.

Last year the Tramways Company made an experiment with a bituminous concrete for paving their track. The success met with is indicated by the use of the same material for the present repair of the track on other sections.

## BIRMINGHAM.

Bonus to Encourage Economical Running—Wounded Soldiers' Rides.

Attention was directed by Councillor Marks at the June meeting of Birmingham Corporation to the consumption of energy per car-mile having increased from 1·9 units for 1915-16 to 2·002 for the past year. Councillor Harrison Barrow, chairman of the Tramways Committee, said the department had now reinstated the bonus system for motormen to encourage economical running, and they hoped to reduce the consumption to the pre-war standard. Since the war, however, the drivers had had to contend with the difficulty of more heavily-loaded cars. The Birmingham and Wigan Tramways Committees have restricted the number of wounded soldiers travelling free on any single car to half a dozen. It was pointed out at Wigan that as many as 90 had boarded a single car, and that colliers and mill operatives had had to walk.

## BLACKBURN.

A Blackburn Corporation car accidentally knocked down a two-year-old child who ran in front of it. In his evidence the motorman stated that he was proceeding slowly, and he pulled up in less than half the car length. Replying to the coroner, he said he could not have stopped more quickly; the slower the speed the longer the electric brake took to act. The Coroner: So there is some safety in driving more quickly. Witness: The brakes act more quickly.

## BOLTON.

Communication with a Railway Station.

The Tramways Committee have adopted the general manager's report on the proposals to alter the terminus of the Bolton cars on the Moses Gate route from the present position in Gravel Hole Brow, near the goods entrance, to a point opposite the centre of the square in front of Moses Gate Station. It will be necessary to construct a new cross-over.

## BOURNEMOUTH.

Substitution in Materials.

The general manager of the Corporation Tramways in his annual report says:—"The abnormal and high prices of all materials, the difficulties of obtaining permits, and the impossibility of obtaining any requirenents in many cases have made it necessary in several cases to adopt substitutes. All copper, malleable iron, and steels are unprocurable, and the outlook for future supplies does not look like improving. Thanks, however, to the loyalty and good work of the staff, all these difficulties have been met." Councillor Bell, chairman of the Tramways Committee, commenting upon the report, said that when it again became possible to buy rails the prices would be greatly enhanced. A very large sum would have to be expended on renewals.

## CHESTERFIELD.

Purchase of Motors and Gearing from Belfast Tramways.

During the general inability to secure materials for renewals, tramway managers have for some time been solving some aspects of the problem by purchases from their respective undertakings. Thus the Chesterfield Corporation Tramways Committee have bought eighteen tramway car motors with gearing from the Belfast Corporation for the re-equipment of some of their cars. The price agreed upon is £2,000.

## HUDDERSFIELD.

Motormen and Fares.

At the termini of the tramways the motormen see that the passengers alighting by the front platform do not leave without paying their fares. In a summons against a spinner, it was stated that the conductor had not finished collecting when the car arrived at the market-place. Defendant and others came down the front staircase, and the driver asked if they had got tickets. Two went back for theirs, but defendant said he had got one and left the car. The driver was doubtful, and called an inspector. The fine was ten shillings.

## KEIGHLEY.

Extension of the Generating Station.

An extension of the Corporation electricity station has been opened by the Mayor. The undertaking was inaugurated in 1901 for supplying energy for the tramways and for lighting, but industries now take a greater part of the output. Mr. Harry Webber, borough electrical engineer and tramways manager, in a souvenir booklet, states that the enterprise has for five years been self-supporting, with a fairly reasonable margin of profit going to the reserve fund, while paying a fair proportion towards the general district fund. The price per kilowatt for the whole undertaking is only £15·38;

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probably as low as any in the United Kingdom. The price obtained during the year ended March, 1916, was ·86d., averaging the returns of traction, lighting, and power, the rates of charge varying from 5d. per unit to a little under a halfpenny. In 1910 the plant capacity was only 740 kilowatts; now it is 10,000.

### LEEDS.

TRAMWAYS AID TO FOOD PRODUCTION.

Leeds Education Committee have started a scheme to enable volunteers from the schools to give one day's work in a fortnight to farmers whose land is within easy reach of a tramway. Tramways are proving a convenience to cultivators of new allotments on the outskirts of towns.

### LIVERPOOL.

UPKEEP OF LEASED TRAMWAYS—EMPLOYEES AID THE RED CROSS SOCIETY.

Bootle Council have entered into a fresh agreement for a period of twenty-five years from July 1 with Liverpool Corporation for the repair and maintenance of the Bootle tramways. Liverpool is to pay a rental of £500 a year for the first six years and £1,000 a year for the remaining period, and will be responsible for the upkeep of the rails and paving within the tramway limits, Bootle Corporation to do the final reinstatement work. Liverpool is to allow £43 per mile per annum for maintenance of the overhead equipment, which is to be handed over at the end of the period in a proper usable condition. All claims under the arbitration as to the upkeep of the tramway in the past are to be withdrawn, each party paying their own costs, and Liverpool will refund the amount of rent outstanding. The Tramways Committee have adopted a plan prepared by Mr. C. W. Mallins, the tramways manager, after consultation with the conductors, by which it is hoped to raise considerable funds for the Red Cross Society and the prisoners of war in enemy countries. Each conductor is upplied with £1 worth of Red Cross tickets, which are sold to passengers. There is no lottery in the scheme, and in six days it realised a sum of £660.

### LONDON.

WOMEN CONDUCTORS' SUMMER UNIFORM—BOXES FOR UNCOLLECTED FARES—DISHONEST PASSENGERS' TRICK—A RECORD DAY'S RECEIPTS—OMNIBUS STRIKE AND TRAMWAY RECEIPTS.

Serviceable and becoming summer coats have been issued to the women conductors on the London County Council Tramways. The material is washable fawn with blue collar and cuffs. Owing to the difficulty of collecting all fares on a crowded car the manager of Leyton Urban Council Tramways, as already reported, has had boxes fixed on the cars, in order that passengers whose fares have not been collected may pay as they alight. The innovation is a convenience to honest people, and boxes in a prominent position and boldly labelled will possibly have the effect of reminding bilkers that they run the risk of the observation of the other occupants of the car, who will naturally take an interest in the experiment. The County Council are continuing their campaign against passengers who leave without having paid the fare. The prosecuting solicitor has stated that the common trick is to alight with a penny in the hand and offer it in payment if by chance they are stopped. Owing to the railway restrictions, and to the suspension of halfpenny fares and return tickets, the Whit-Monday receipts on the London County Council Tramways totalled £13,000, which is several thousand pounds in excess of the takings on any one day. At the Council's meeting on June 19 Mr. H. H. Gordon said that whatever view was taken of the fare changes, the traffic returns showed an increase of 5½ millions of passengers and of £42,000 for the four weeks ended June 6. The increased fares had been in operation only during the last fortnight of that period, but of the 5½ millions increase in passengers some 4 millions took place before the increase of fares. That increase was explained largely by the strike of omnibus employees. From the returns of East Ham Corporation Tramways for the period of the strike of omnibus employees we note that on the first day (Sunday) the car receipts showed an increase of £127. For the first four weekdays in the following week the increase was £680.

### MANCHESTER.

CAPITAL EXPENDITURE FOR 1917-18—ELECTRICITY COMMITTEE'S ESTIMATES.

The continued restriction of expenditure owing to the war is seen in the Tramway Committee's estimates for 1917-18, providing for a capital expenditure of £721 on buildings and £1,142 on permanent way. The estimates of the Electricity Committee for the current year provide for an outlay of £171,000, of which part is for buildings for the new generating station.

### NEWPORT.

IMMEDIATE EXTENSION OF THE TRAMWAYS.

The Light Railway Commissioners, sitting at Newport, have sanctioned an application by the Corporation to extend the tramways from Commercial Road to the entrance to the Alexandra Dock, in order to provide for the transport of 1,500 workers engaged at a new factory. In the immediate future the number of employees will be 6,000. This extension was applied for in 1902 as a work required to complete the tramways, and the railways had now withdrawn the opposition to passing over their level crossings. The extension will be a little over three furlongs, and Mr. Nichols Moore, borough electrical engineer, estimated the total cost, including level crossings over the railways, at £13,062. In connection with this scheme the engineer advised the laying down of mastic asphalt paving on the tracks over part of the line, and the Council have entered into a contract with the Limmer and Trinidad Lake Asphalt Company, Limited, for the carrying out of this work. At the meeting of the Council on June 12, the engineer submitted tenders for the construction of the light railway, and reported that the prices were so greatly in excess of the estimate that he advised the work should be done by direct labour. This recommendation was adopted.

### NORWICH.

CARS TO GIVE AIR RAID WARNING.

Norwich tramcars, in the event of a daylight aircraft raid warning, will bear a notice, "Hostile Aircraft Approaching: Seek Shelter."

### SHEFFIELD.

AUTOMATIC TROLLEY REVERSERS IN GENERAL USE—WOMEN CONDUCTORS MORE EXPENSIVE—GREAT MUNITION TRAFFIC.

On the Corporation tramways there are now 90¼ miles of trolley wire in use, and during the past financial year 5¼ miles have been renewed. The undertaking has twenty-four automatic trolley reversers in operation. There has been some newspaper correspondence on the refusal of the City Council to pay the women conductors a war bonus equal to that of the men. The salient point to be drawn from the remarks of Sir Wm. Clegg, chairman of the Tramways Committee, in submitting the bonus resolution to the Corporation, and around which the controversy has been waged, is that women conductors are not physically capable of rendering service equal to that given by men. The general manager estimates that 700 women are necessary to do the same amount of work as 550 men; that is to say, 14 women are required to replace 11 men. In spite of that fact the women are paid the same wages as men, though on that basis they are worth only 25s. In other words, to do the same amount of work with women costs about £240 a week more, or over £12,000 a year. This sum is equivalent to a rate of nearly 2d. in the pound. Nearly 50 per cent. of the employees are women, there being 1,088 women and 936 men, a total of 2,024. Of the 543 employees who have joined the forces, one man has returned permanently disabled and 37 have been reported killed or missing. During the past year, in order to deal with munition workers' traffic, the rolling stock has been increased by the purchaee of ten second-hand cars from the London County Council, and the stock now consists of 349 service cars, thirteen stores, etc., cars, and twenty-two motor omnibuses.

## PATENT LIST.

### Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

High-speed electric locomotives (7,679)—British Thomson-Houston Company and F. W. Carter.
Motor road vehicles (7,709)—G. F. Campion.
Devices for propelling railway rolling stock, etc. (7,766)—J. Neil.
Lifting jacks, etc. (7,849)—F. L. Rapson.
Transport vehicles propelled by endless moving chain tracks (7,897)—Sir W. A. Tritton.
Trolley wheels for electric traction (8,012)—W. C. Ashbury and W. D. King.
Trailers for commercial motor vehicles (8,026)—J. Banks.
Spring suspension mechanism of motor vehicles (8,239)—Birmingham and Midland Counties Transport Company and G. E. D. Ralls.
Motor chassis (8,121)—J. Cox.
Braking or steering devices for motor vehicles (8,131)—J. Cox.
Electrical power transmission for motor vehicles (8,058)—Daimler Company and F. W. Lanchester.
Motor to drive vehicle on its own inducted electric current (8,089)—G. E. Harfield.
Speed gear for motor vehicles (8,484)—G. Barker and H. Stevenson.
Vehicle steering gear mechanism (8,321)—Caterpillar Tractors, Limited (*Holt Manufacturing Company*).
Chairs for railway sleepers (8,663)—R. Fairhurst and C. Heyes.
Reinforced concrete sleepers for railways (8,511)—P. Blair-Frost.
Automatic train stops (8,425)—National Safety Appliance Company.
Suspension devices for motor vehicles (8,635)—R. Esnault-Pelterie.
Automatic couplings for railways and tramways (8,334)—U. A. Tesorieri.
Electric locomotives (8,854)—British Thomson-Houston Company (*General Electric Company*).
Braking systems for electrically-driven vehicles (9,061)—British Thomson-Houston Company (*General Electric Company*).
Light motor vehicles (9,068)—G. A. Dunball.

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Steering mechanism for motor vehicles (8,823)—C. H. Edye and C. L. Heyermans.
Electrically-driven road vehicles (8,937)—F. La Roche.
Change-speed gear and clutches for use therewith for motor vehicle engines (8,969)—H. Lindblom.
Signalling and train-stopping apparatus (9,035)—E. H. Whytehead.

### Specifications Published.

1915

Train brake systems (18,213)—Sprague Safety, Control, and Signal Corporation.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Reversing controller for electric motors used on petrol electric cars (6,249—*105,956*)—W. A. Stephens.
Chassis construction on motor vehicles (6,905—*105,999*)—H. E. Buck.
Means for expediting and safeguarding railway traffic (15,429—*106,051*)—H. A. Thompson.
Automatic block signal systems for railways (4,337—*100,779*)—National Safety Appliance Company.
Air-brake apparatus (6,497—*100,636*)—California Valve and Air Brake Company.
Controlling mechanism for compound brakes (6,657—*106,131*)—Knorr-Bremse Akt.-Ges. and W. Hildebrand.
Automatic train-stopping mechanism (6,814—*101,785*)—National Safety Appliance Company.
Track belt for motor vehicles (8,463—*106,353*)—A. Kegresse.
Electric controllers for vehicles (9,702—*106,358*)—C. P. Elieson and E. G. Payne.
Temporary axles for motor road vehicles (12,002—*106,381*)—J. B. Brown and D. Cairns.
Automatic air-brake systems (12,167—*101,348*)—Sprague Safety, Control, and Signal Corporation.
Rail dressing machines (14,581—*106,413*)—W. E. Hanshue.
Spring mountings for motor vehicles (18,371—*106,437*)—Birmingham and Midland Counties Transport Company and G. E. D. Ralls.
Motor vehicles (7,298—*106,525*)—A. Bonfa.

**40,000 Employees Subscribe.**—As an indication of the general interest of electrical workers in America in providing the sinews of war, the following information taken from the *New York Times* is illuminating:—Over 40,000 employees of the General Electric Company of New York have subscribed for $3,000,000 worth of Liberty Loan Bonds, an average of $75 per individual. The subscriptions were received from the Schenectady, Lynn, Harrison, Fort Wayne, Erie, Pitsfield, and other works of the company, as well as from their district offices, and are symptomatic of the attitude of the whole of America.

## Colonial and Foreign Tramways Traffic Returns.

| NAME OF COMPANY. | 1916. WEEKS ENDED. June 3. | June 10. | June 17. | June 24. | | 1917. WEEKS ENDED. June 2. | June 9. | June 16. | June 23. | | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | | £ | £ | £ | £ | | | £ | £ |
| Anglo-Argentine ... ... ... | 50.805 | 48.644 | 49.888 | 48.580 | ... | 51.765 | 54.115 | 48.420 | 52.296 | ... | 25 | 1,287.420 | + 8.087 |
| Auckland ... ... ... ... | 21.152 | (28 days) | ... | ... | ... | 21.742 | (28 days) | ... | ... | ... | 48 | 259.101 | + 6.043 |
| Calcutta ... ... ... Rs. | 63.676 | 63.208 | 64.281 | 66,419 | ... | 65.367 | 64.050 | 66.259 | 65,969 | ... | 25 | 1,685,060 | + 19,840 |
| Madras ... ... ... Rs. | ... | (14 days) | 30.277 | ... | ... | ... | (14 days) | 32.142 | ... | ... | 23 | 375.924 | + 34.832 |
| Pernambuco ... ... ... ... | 2.829 | 2.880 | 2.930 | 2,729 | ... | 3.814 | 3.882 | 3.725 | 4,145 | ... | 25 | 94,754 | + 17,769 |

## Companies Issuing Monthly Statements.

| | 1916. Jan. | Feb. | March. | April. | May. | June. | 1917. Jan. | Feb. | March. | April. | May. | June. | Wks. | AGGREGATE. 1916-17. | + or −. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Ballarat & Bendigo ... | 3,399 | 3,512 | 3.881 | 3,727 | ... | ... | 3.521 | 3.196 | 3.422 | 4.611 | ... | ... | 4 | 4.611 | + 884 |
| Brazilian Traction Mirs | 6626000 | 6276000 | 6913000 | 6882000 | 7304000 | ... | 7266000 | 6872000 | 7549000 | 7453000 | 7864000 | ... | 21 | 37.004.000 | + 3.003.000 |
| Brisbane ... ... | 32,280 | 30,320 | 34,275 | 32 575 | 33,150 | ... | 33.020 | 29.800 | 33.340 | 31.620 | 33.340 | ... | 21 | 161.120 | − 1.840 |
| British Columbia | $591,949 | 572,935 | 446,401 | 421,265 | 414,215 | ... | 627.130 | 581.555 | 456.626 | 447.429 | 438,919 | ... | 47 | 4.952.727 | + 290.427 |
| Buenos Ayres Lacroze | 40,595 | 39,137 | 42.219 | 40.220 | 40,220 | 36,213 | 38.142 | 35.977 | 41.337 | 39.111 | 40.595 | 38,020 | 52 | 464.077 | − 25.457 |
| Burma ... ... | 21,906 | 20,345 | 22 958 | 22,191 | 23,585 | ... | 23.803 | 22.912 | 27.132 | 23.660 | 24.906 | ... | 44 | 257.416 | + 27.698 |
| Cape Town ... ... | 16,030 | ... | 14.994 | ... | ... | ... | 18.440 | 16.229 | 17.688 | 16.705 | 15.867 | ... | 21 | 84.829 | — |
| Carthagena & Herrerias | 2,841 | 1,585 | 2 991 | 2,513 | 2,927 | 3,512 | 3.982 | 3.223 | 2.955 | 4.366 | 4.321 | 5,325 | 26 | 24.172 | + 7.803 |
| Cordoba ... ... | 12,335 | 11,831 | 13,598 | ... | ... | ... | 12.437 | 11.898 | 13.098 | ... | ... | ... | 52 | 160.683 | − 1.223 |
| East India ... ... | 2,015 | 1,863 | 2,196 | 2,116 | 2,161 | 2,285 | 1.836 | 1.570 | 1.647 | 1.445 | 1.455 | 1,186 | 48 | 20.326 | − 2.824 |
| Kalgoorlie ... ... | 2,236 | 2,249 | 2,479 | ... | ... | ... | 2.431 | 2.193 | 2.772 | ... | ... | ... | 13 | 7.396 | + 433 |
| La Plata ... ... | 4,533 | 4,345 | 4.611 | 4,354 | 4.342 | 3,735 | 4.315 | 4.092 | 4.527 | 4.229 | 4,126 | 3,852 | 26 | 25.144 | − 781 |
| Lima ... ... ... | ... | ... | 34,169 | 33,542 | 33.966 | ... | ... | ... | 37.569 | 37.807 | 35.321 | ... | 21 | 181.809 | + 13.098 |
| Manaos ... Rs. | ... | ... | ... | ... | ... | ... | 146.493 | 144.532 | 161.156 | ... | ... | ... | — | — | — |
| Manila ... ... $ | ... | 66,303 | ... | ... | 53,900 | ... | ... | 73.200 | ... | ... | 61,500 | ... | — | — | — |
| Mexico ... $ | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Monte Video ... ... | 34,252 | 32,502 | 31,956 | 28,997 | 28.349 | 25,300 | 33.341 | 32.304 | 31,979 | 29,230 | 28.716 | 27,458 | 35 | 242.796 | + 1,728 |
| Peruvian ... $ | 862,100 | 775,700 | ... | ... | 826,900 | 929,500 | 935.130 | 844.770 | ... | ... | 902.780 | 965,420 | 52 | 11.128.092 | + 1.364.595 |
| Port Elizabeth ... | 4,193 | 3,857 | ... | ... | ... | ... | 4.498 | 3.553 | 4.428 | 3.904 | 3.494 | ... | 21 | 19.877 | — |
| Rangoon ... ... | 4,763 | 4,674 | 5,501 | 4 849 | 4.589 | ... | 4.633 | 4.605 | 6.226 | 5.036 | 4737 | ... | 21 | 25.237 | + 861 |
| Toronto ... $ | 906,350 | 846,256 | 910.969 | 883,209 | 903,924 | ... | 1002469 | 932.567 | ... | 970.367 | 992,460 | ... | 21 | 4.889.055 | + 438.347 |
| Winnipeg ... $ | 297,560 | 293,250 | 296,500 | 282,498 | 276,980 | ... | 319.945 | 280.717 | 293,094 | 265.594 | 259,794 | ... | 21 | 1,419.144 | − 27,644 |

(*Continued on page 42*)

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# TRAFFIC RETURNS—*continued.*

## Tramways and Omnibus Undertakings in the United Kingdom.

| NAME OF COMPANY OR CORPORATION. | 1916. WEEKS ENDED. June 3. | June 10. | June 17. | June 24. | 1917. WEEKS ENDED. June 2. | June 9. | June 16. | June 23. | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Aberdare U.D. Council | 356 | 351 | 447 | 389 | 557 | 453 | 405 | 415 | 11 | 4.839 | + 416 |
| Aberdeen Corporation | 2.088 | 1.855 | 1,785 | 1,840 | 2.434 | 1.821 | 2.972 | 2.228 | 3 | 6.446 | + 965 |
| Accrington Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ayr Corporation | 356 | 380 | 435 | 462 | 370 | 421 | 472 | 471 | 6 | 2.445 | + 94 |
| Bath Electric | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Belfast City | ... | 5,560 | 5,639 | 5,628 | ... | 6.318 | 6.591 | 6.448 | 12 | 72.009 | + 5.098 |
| Birkenhead Corporation | 1.464 | 1.534 | 1.585 | 1.598 | 1.931 | 1.884 | 1.946 | 1.859 | 12½ | 20.895 | + 2.568 |
| Birmingham Corporation | 16.411 | 15.933 | 16.978 | 16.250 | 20.108 | 17.549 | 18.117 | 17.718 | 12 | 210.949 | + 12.315 |
| Birmingham Corp. Motor Omnibuses | 990 | 870 | 1.051 | 1.007 | 1.148 | 844 | 890 | 936 | 12 | 10.630 | − 700 |
| Blackburn Corporation | ... | ... | 1.345 | ... | ... | ... | 1.522 | ... | 12½ | 18.236 | + 2,177 |
| Blackpool and Fleetwood | 649 | 544 | 1.543 | 1.024 | 1.454 | 901 | 844 | 810 | 23 | 11.864 | − 665 |
| Blackpool Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bolton Corporation | 2.723 | 2.995 | 3.192 | 2.957 | 3.620 | 3.565 | 3.353 | 3.172 | 12 | 38.939 | + 3.113 |
| Bournemouth Corporation | 1.945 | 2.310 | 2.267 | 2.216 | 2.474 | 2.475 | 2.423 | 2.441 | 12½ | 28.533 | + 254 |
| Bradford Corporation | 6.515 | 6.200 | 7.729 | 6.725 | 10.048 | 7.321 | 8.271 | 7.647 | 12 | 89.745 | + 6.895 |
| Brighton Corporation | 1.103 | 1.143 | 1.259 | 1.230 | 1.673 | 1.499 | 1.534 | 1.426 | 12½ | 16.078 | + 2.024 |
| Bristol | 4.961 | 4.528 | 5.446 | 5.151 | 7.304 | 5.869 | 6.145 | 5.862 | 24 | 125.734 | + 8.933 |
| Burnley Corporation | 1.680 | 1.694 | 1.525 | 1.626 | 2.299 | 1.789 | 1.855 | 1.745 | — | — | — |
| Burton-on-Trent Corporation | 266 | 273 | 269 | 264 | 320 | 293 | 296 | 289 | 22 | 3.371 | + 193 |
| Bury Corporation | 1.336 | 1.360 | 1.816 | 1.569 | 2.059 | 2.057 | 1.690 | 1.554 | 12½ | 19.827 | + 1.669 |
| Cardiff Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Chatham and District | 1.294 | 1.183 | 1.235 | 1.334 | 1.770 | 1.584 | 1.540 | 1.500 | 25 | 30.224 | + 2.011 |
| Chesterfield Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Colne Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Cork Electric | 551 | 508 | 544 | 585 | 623 | 585 | 655 | 663 | 25 | 12.475 | + 626 |
| Croydon Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Derby Corporation | 1.108 | 1,067 | 1.174 | 1.134 | 1.413 | 1.192 | 1.221 | 1.183 | 12 | 13.794 | + 96 |
| Dover Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin and Lucan | 179 | 153 | 179 | ... | 238 | 176 | 198 | ... | 24 | 3.404 | + 396 |
| Dublin United | 6.508 | 6.092 | 6.558 | 6.890 | 7.892 | 6.836 | 7.367 | 7.630 | 25 | 156.449 | + 18.974 |
| Dundee City | ... | 1.393 | 1.369 | 1.398 | ... | 1 512 | 1.559 | 1.571 | 5½ | 7.789 | + 603 |
| East Ham Corporation | 1.350 | 1.308 | 1.318 | 1.376 | 1.618 | 1.449 | 1.500 | 1.413 | 12 | 17.178 | + 1.456 |
| Exeter Corporation | 385 | 364 | 407 | 392 | 433 | 407 | 426 | 420 | 12 | 4.526 | − 6 |
| Gearless Motor 'Buses | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Glasgow Corporation | 24.328 | 23.559 | 24.672 | 24.389 | 27.539 | 26.923 | 28.108 | 27.013 | 3½ | 91.571 | + 12,666 |
| Glossop (Urban Elec. Supply Co.) | 141 | 127 | 159 | 140 | 199 | 170 | 173 | 163 | 25 | 3.466 | + 135 |
| Halifax Corporation | 2.202 | 2.102 | 2.600 | 2.353 | 3.914 | 2.471 | 2.620 | 2.681 | 11½ | 27.751 | + 1.372 |
| Halifax Corp. Motor Omnibuses | 49 | 46 | 53 | 50 | 67 | 41 | 23 | 42 | 11½ | 487 | − 54 |
| Hastings and District | 1.041 | 922 | 1.029 | 1.038 | 1.468 | 1.287 | 1.435 | 1.263 | 25 | 25.606 | + 4.281 |
| Huddersfield Corporation | 2.928 | 2.653 | 3.718 | 2.810 | 4.834 | 3.151 | 3.477 | 3.233 | 12 | 38.429 | + 2.703 |
| Hull Corporation | 3.106 | 3.074 | 3.158 | 3.163 | 3.683 | 3.322 | 3.394 | 3 380 | 17 | 39.504 | + 1.962 |
| Ilford U.D. Council | 700 | 645 | 692 | 690 | 956 | 783 | 773 | 757 | 12 | 8.978 | + 725 |
| Ilkeston Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ipswich Corporation | 613 | 551 | 602 | 604 | 903 | 707 | 751 | 708 | 12 | 7.295 | + 997 |
| Isle of Thanet | 337 | 309 | 355 | 366 | 492 | 354 | 356 | 440 | 38 | 10.317 | − 153 |
| Kilmarnock Corporation | 161 | 161 | 170 | 188 | 180 | 182 | 183 | 183 | 5½ | 1.007 | + 43 |
| Lanarkshire | 2.336 | 2.310 | 2.358 | 2.574 | 2.923 | 3.066 | 3.144 | 3.065 | 25 | 63.940 | + 8.971 |
| Lancashire United | 1.819 | 1.652 | 1.892 | 2.126 | 3.063 | 3 431 | 2.559 | 2.495 | 25 | 50.757 | + 8.459 |
| Leeds City | 9.650 | 9,169 | 10.481 | 9.832 | 14.354 | 10.642 | 11.574 | 10.998 | 12 | 129.901 | + 13.582 |
| Leicester Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Leith Corporation | 843 | 843 | 862 | 882 | 1.001 | 1.051 | 1.096 | 1.077 | 5½ | 5.819 | + 998 |
| Leyton U.D. Council | 1.724 | 1.554 | 1.618 | 1.750 | 2.376 | 1.958 | 2.057 | 1.898 | 12 | 22.903 | + 3.313 |
| Liverpool Corporation | 14.296 | 13.645 | 14.793 | 14.468 | 16.966 | 16.065 | 16.908 | 16.228 | 24½ | 367.036 | + 28.606 |
| Llandudno and Colwyn Bay | 323 | 339 | 571 | 447 | 500 | 383 | 372 | 393 | 29½ | 6,845 | − 592 |
| London County Council | 49.409 | 47.603 | 47.611 | 48.866 | 62.596 | 56.833 | 58.184 | 55.323 | 11½ | 630.192 | + 79.173 |
| London General Omnibus | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| London United | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Lowestoft Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Maidstone Corporation | 206 | 192 | 195 | 203 | 291 | 251 | 244 | 238 | 12 | 2.751 | + 183 |
| Manchester Corporation | 18.868 | 17,617 | 20.852 | 19.339 | 23.554 | 21.298 | 22.062 | 20.934 | 12 | 244.503 | + 19.649 |
| Metropolitan Electric Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| National Steam Car | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Nelson Corporation | ... | ... | 252 | 203 | ... | ... | 225 | 219 | 12 | 2.740 | + 75 |
| Newcastle-on-Tyne Corporation | 6.698 | 6.487 | ... | ... | 8.579 | 7.691 | ... | ... | 10 | 74.493 | + 11,932 |
| Newport (Mon.) Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| New St. Helens and District | 1.005 | 892 | 1.139 | 1.126 | 2.072 | 1.699 | 1.546 | 1.476 | 51 | 58.298 | + 7.520 |
| Northampton Corporation | ... | ... | ... | 666 | ... | ... | ... | 823 | 12 | 9.363 | + 1.031 |
| Nottingham Corporation | 3.852 | 3.663 | 3.924 | 3.896 | 5.592 | 4.172 | 4.473 | 4.386 | 12 | 49.363 | + 3.894 |
| Oldham Corporation | 2.302 | 2.447 | 2.908 | 2.591 | 3.168 | 3.396 | 3.053 | 2.744 | 13 | 36.271 | + 2.991 |
| Portsmouth Corporation | 2.802 | 2.472 | 2.757 | 2.727 | 3.420 | 3.330 | 3.344 | 3.074 | — | — | — |
| Preston Corporation | 1.070 | 1.032 | 1.340 | 1.037 | 1.517 | 1.131 | 1.197 | 1.192 | 11½ | 13.481 | + 710 |
| Provincial | 2.441 | 2.182 | 2.507 | 2.468 | 3.107 | 2.892 | 2.800 | 2.619 | 38 | 80.960 | + 62 |
| Reading Corporation | 836 | 760 | 827 | 826 | 1.198 | 1.031 | 1.081 | 1.088 | 11½ | 11.483 | + 1.859 |
| Rhondda Tramways | 1.237 | 1,187 | 1.554 | 1,315 | 2.301 | 1.505 | 1.573 | 1,558 | 25 | 35,198 | + 5,004 |
| Rochdale Corporation | 1.753 | 1.609 | 2.202 | 1.925 | 2.730 | 2.477 | 2.117 | 2.028 | 12 | 24.798 | + 2.342 |
| Rotherham Corporation | 1.392 | 1.571 | 1.539 | 1.573 | 1.782 | 1 718 | 1.759 | 1.683 | 12½ | 21.746 | + 3.761 |
| Salford Corporation | 5.277 | 5.374 | 6.374 | 5.576 | 7.732 | 6.776 | 6.966 | 6.382 | 12½ | 78.778 | + 11.069 |
| Sheffield Corporation | 10,133 | 10.226 | 10.981 | 10.685 | 12.966 | 11.753 | 11.986 | 11.609 | 13 | 150.539 | + 16.666 |
| Southampton Corporation | 1.638 | 1.503 | 1.629 | 1.712 | 2.195 | 2.008 | 2,072 | 2.077 | 11½ | 21.607 | + 3.161 |
| Southend-on-Sea Corporation | 837 | 797 | 872 | 849 | 1.422 | 1.204 | 1.026 | 1.003 | 12 | 10,409 | + 1.087 |
| South Metropolitan Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| South Shields Corporation | 819 | 783 | 809 | 820 | 1.132 | 908 | 964 | 940 | 12 | 10.846 | + 1.377 |
| Sunderland Corporation | 1.564 | 1.563 | 1.607 | 1.618 | 2.133 | 1.785 | 1.908 | 1.802 | 12 | 20.955 | + 1.824 |
| Sunderland District | 612 | 718 | 649 | 606 | 1.118 | 592 | 756 | 794 | 34 | 22.524 | + 2.869 |
| Swindon Corporation | 182 | 207 | 182 | 205 | 273 | 289 | 273 | 286 | 11½ | 3.045 | + 751 |
| Torquay Tramways | 588 | 504 | 626 | 634 | 782 | 657 | 695 | 712 | 25 | 13,097 | + 932 |
| Tramways (M.E.T.) Omnibus Co. | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Tyneside Tramways and Tramroads | 624 | 602 | 620 | 667 | 1.404 | 871 | 1.002 | 1,035 | 25 | 17.867 | + 4,525 |
| Wallasey Corporation | 1.285 | 1.237 | 1.512 | 1.417 | 1.853 | 1.547 | 1.708 | 1.557 | 12½ | 17.416 | + 1.285 |
| Walsall Corporation | 800 | 796 | 954 | 798 | 1.305 | 875 | 931 | 910 | 12 | 11.135 | + 991 |
| Walthamstow U.D. Council | 1.172 | 935 | 1.070 | 1.127 | 1.753 | 1.350 | 1.330 | 1.242 | 12 | 15.008 | + 2.157 |
| Warrington Corporation | 478½ | 466 | ... | ... | 584 | 533 | ... | ... | 10 | 4.825 | + 230 |
| West Ham Corporation | 3.403 | 3,176 | 3.229 | 3.306 | 4,323 | 3.821 | 3.991 | 3.680 | 11½ | 43.511 | + 4.846 |
| Wigan Corporation | ... | ... | ... | 1 654 | ... | ... | ... | 1.921 | 3 | 22.379 | + 2.447 |
| Wolverhampton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Yorkshire (West Riding) | 1.631 | 1,761 | 2.059 | 1,718 | 3.316 | 2.311 | 2.145 | 2.047 | 25 | 49.518 | + 7.569 |

### * TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

### TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.


### THE TRAMWAY AND RAILWAY WORLD

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# Extract from the Commercial Motor

*June 21st, 1917*

## "Chariots of War I have Driven"

### No. 5—The Daimler

**By one of our "Despatches" Contributors**

IT is probable that, of all the many motor factories whose products are in use by the British Armies, none has contributed so many chassis and components as the Daimler factories, not even excepting those turning out the ever-evident Ford. Wherever one goes behind the Western Front, Daimlers are features of the landscape. Consequently, thousands of drivers have obtained experience, or added to previous knowledge, of Daimler cars and lorries; and many have come to swear by them—not at them, as is the case with some makes! Daimlers of every kind, type and age seem to be represented, from the latest arrivals "just come out" to old impressed motorbus chassis or lorries which arrived on the scene in 1914, and are still running. Daimler touring cars, landaulets, limousines, light and heavy lorries and delivery vans—one could not escape them if one would, but their silence and sweet running make them rather attractive than otherwise. Then, of course, there are Foster-Daimler tractors for big gun haulage, to which the great Coventry workshops contribute some of the principal units. and last, but by no means least, the Tanks, in which are embodied important components of Daimler manufacture.

One of the chief attractions of Daimler lorries for the driver is their extreme simplicity. The number of parts that go to make up a Daimler lorry chassis is rather less than usual, so the ordinary driver finds those minor but constant attentions demanded by every war lorry well within his scope during the intervals between frequent journeys. One might almost say that Daimlers require rather less attention than other makes. For example, the flexible ring, leather or composition couplings do not need lubrication, and they make no demand on the driver's time, except for an occasional inspection, and, possibly, tightening of the bolts. The absence of separate torque or thrust members involves a minimum of lubrication and cleaning time. There are no external pipes, gauges, indicators or pumps forming parts of the engine lubrication system. Oil has only to be poured into the crankcase filler, and the lubrication then takes care of itself. These are points which commend themselves to drivers and make for the most efficient maintenance of a chassis by reducing the number of parts that have to be regularly watched, cleaned, lubricated or tightened.

No mistake can be made about over-oiling the motor or back axle, because the maximum oil level is determined by the height of the fillers. One merely pours in as much oil as is needed to fill right up, which method is the acme of simplicity. It has seemed to me that the filler lids could be improved on by the addition of a rim to exclude dirt.

As a rule, the adequacy of the springing of Daimler lorries is less open to criticism than that of most solid-tyred road vehicles. Their adoption for passenger work on such a large scale, and the use of an exactly similar system of suspension on L.G.O.C. vehicles is a striking tribute to the comparative efficiency of this particular type of springing. Perhaps, too, the Daimler's resiliency has largely contributed to its success on war transport, a success attained despite features of design that were unacceptable to the War Office M.T. Committee prior to the war, features which, it was generally considered, would not stand up under the onerous conditions of war service.

Daimler

**The Daimler Company, Ltd., Coventry**



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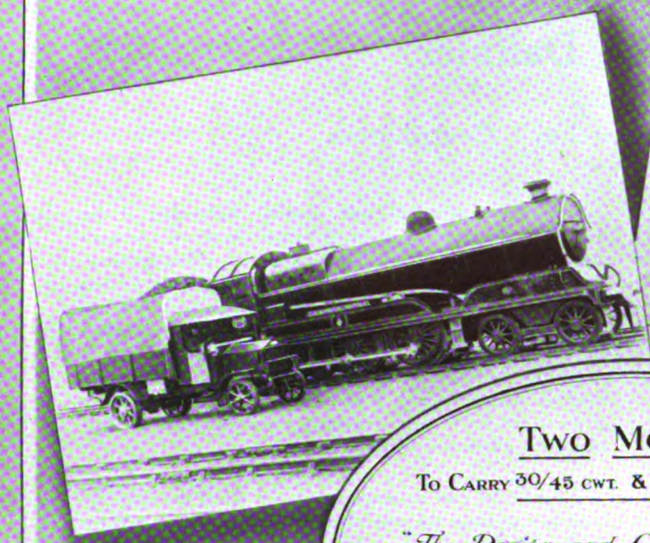
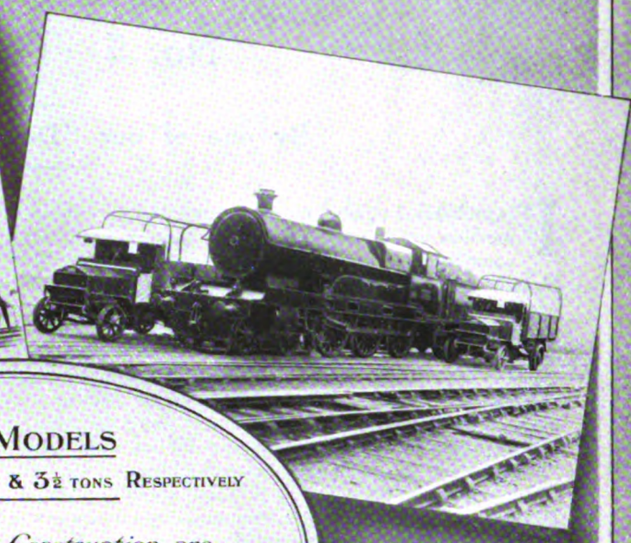
# NAPIER

## MOTOR VEHICLES.





TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

*"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."*

*RAILWAY GAZETTE, MARCH 31, 1916.*

IN PEACE

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

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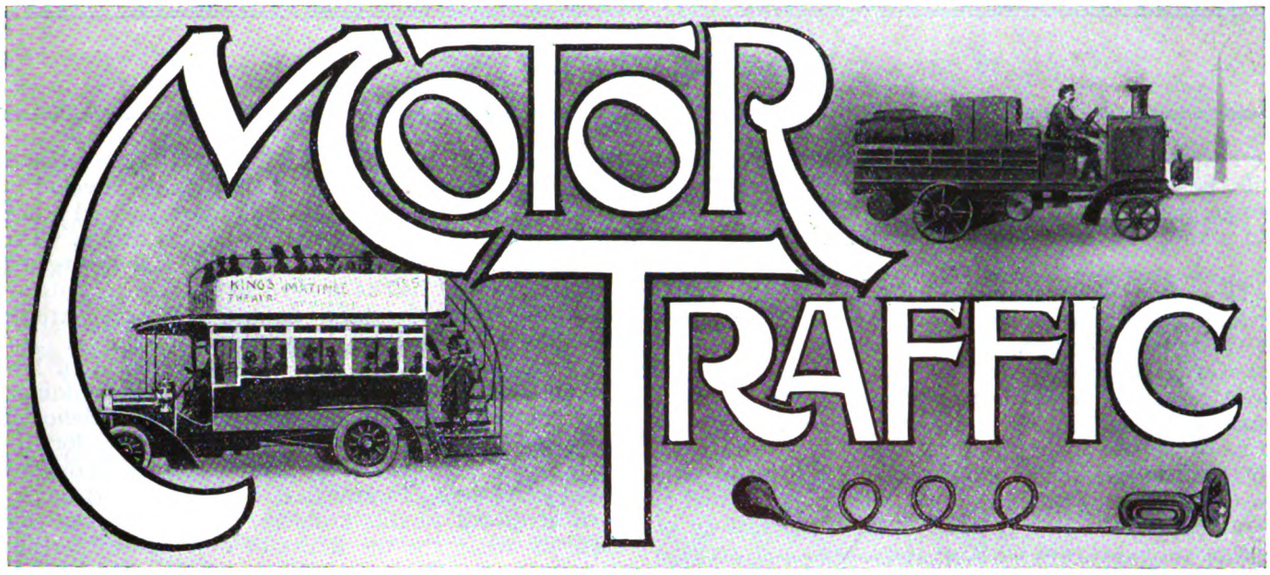


The position of motor omnibus undertakings during the war has not, on the whole, been enviable, and it says much for the inherent soundness of these enterprises and the ability with which they have been conducted that the results shown are so generally satisfactory. Until the beginning of the present year, when the increased railway fares came into force, it may be said with literal truth that the effects of the war upon motor omnibus concerns were solely adverse, and unredeemed by any incidental advantage. The conveyance under special arrangements with the Government of munition workers had in some cases considerable effect upon the figures of passengers carried, but it by no means follows that the financial return was correspondingly favourable. When the 50 per cent. addition to railway fares became operative, there was, especially in the London area, a marked rush of former railway passengers to the omnibuses. Since then, however, the petrol situation having become increasingly stringent, much of this new traffic has been lost through sheer inability to cope with it with the present depleted services due to the petrol shortage. In London, at all events, it has been a sufficiently difficult matter to adapt the services to the various fluctuations of the fuel situation, and yet to ensure the maximum possible facilities to the ordinary omnibus-riding public, and there has obviously been no margin whatever to meet any extra demands. In fact, the manner in which the London General Omnibus Company has surmounted its manifold difficulties is an outstanding example of resourceful adjustment to circumstances, and had the emergencies arising from the present upheaval been less ably met, Londoners would have suffered very gravely from inconvenience and confusion in this direction.

* * * * * *

But this record of efficiency and continued success in the face of serious difficulties is not confined to the Metropolis or to privately-owned undertakings. Taking the municipal omnibus services of Birmingham, Sheffield, and Manchester, the accounts recently published exhibit in each case very creditable results. In the case of Birmingham, there has been a considerable increase in the total of omnibus miles run and passengers carried, and nearly 25 per cent. additional vehicles have been placed in service during the twelve months under review. There is, in fact, an increase in passenger receipts from £47,865 for the twelve months ended March 31, 1916, to £62,238 for a similar period to March of the present year. The balance carried to profit and loss account, however, is slightly less than before. Thus it will be observed that the increase in receipts has not kept pace with the additional expenditure. The figures per omnibus mile, it may be remarked, show that as between 1915-16 and 1916-17 expenditure has risen from 9·706d. to 12·012d., an increase of 2·306d.; receipts, on the other hand, have gone up from 12·244d. to 14·248d.—representing a gain of 2·004d. only. The position is, of course, that on an increased scale of operations, profits are being barely maintained at the former level; but, in all the circumstances, more than this cannot reasonably be expected. The case of Sheffield is more or less analogous to that of Birmingham, but in Manchester, where operations are on a comparatively small scale, there is a drop in the net profit from £1,083 in 1915-16 to £158 12s. 11d. for the year ended March, 1917, the traffic revenue having fallen from 11·840d. per omnibus-mile to 9·677d. As against this the cost of petrol has nearly doubled, from 1·521d. per mile to 2·813d., and this, and rises in other classes of expenditure, sufficiently account for the difference.

* * * * * *

These figures, cursory as they are, will give some general idea as to the drawbacks under which motor omnibus enterprise must at present labour. Its burdens are assuredly heavy enough, without unfair addition, and the complaints that have recently been made as to the effect of the provisions of the Local Government (Emergency Powers) Act in imposing what virtually amounts to a double taxation for road maintenance upon motor omnibus owners are far from unreasonable. It is pointed out that, as matters now stand, proprietors are unduly mulcted, inasmuch as they must now pay substantially two separate taxes for the maintenance of roads of which, after all, they are only part-users with the rest of the traffic. The petrol tax was intended originally far less as a tax than as a levy in respect of road maintenance, and the fact that its proceeds are now devoted to the Imperial Exchequer is in itself a legitimate source of grievance on the part of those who have paid it. When, in addition, omnibus undertakings must also submit to taxation by local authorities for the self-same purpose for which the petrol tax was at the outset to serve, it will be seen that they are being asked to shoulder obligations that are both theoretically and practically unfair. The fact that these conditions are ostensibly only temporary, arising from the war, does not affect the issue. Apart from that, moreover,

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here is no guarantee that the *status quo* in this respect will be restored. The present double taxation—temporary or not—is bad, whether it be viewed from the standpoint of equity or economics.

There are very few emergencies that do not sooner or later bring their remedies, and this is certainly true of the petrol shortage. The fact that motor vehicles are now being regularly and successfully run on ordinary town gas gains in significance when one recalls that some of the earlier pre-war attempts to widen the basis of motor spirit supplies were by means of a by-product obtained in gas manufacture. That we should now be using the ultimate product itself as motor fuel is a rather curious development. The whole history of this petrol substitute business is curious, and perhaps rather characteristic of human experience in general. When motor users tried to get over the troubles of petrol shortage and restrictions by using substitutes they found themselves in some trouble as to the legal status of such. The legal difficulty settled, another arose, and substitutes also came under control and restrictions. Of this latter action the effect was not perhaps quite what the authorities intended. It drove the "substitute" off the market, and increased the demand—within the scope of the official allowances—for petrol.

* * * * * *

The use of gas as a substitute is yet in its very early stages, but the essential fact is that by its use vehicles that would otherwise have been standing idle are out on the road again, and the chars-a-banc owners find some possibility of being able to carry on business after all this season. It could be available for use for other vehicles should the "worst come to the worst." It is scarcely conceivable that any prohibitions or restrictions are likely to be deliberately imposed on the development by motor users of this new resource to its full extent. The obstacles that already exist are, perhaps, in themselves sufficiently formidable, concerning, as they do, the lack of labour and materials for the necessary equipment. Apart from these difficulties, there are no others of serious relative importance. The cost of adaptation in a way which, if rough and ready, amply suffices, is about £20, and the result is to make available a perfectly satisfactory motor fuel, the cost of which is equivalent to petrol at something like 11d. per gallon. No alteration to the engine is required, and the gas can be readily interchanged with petrol if necessary. Admittedly there are some disadvantages to be faced; the flexible baloon-like containers increase wind resistance, and do not add to the appearance of the vehicle, but, as already remarked, matters such as these are not of great comparative moment. Some loss of power is shown as compared with petrol, this amounting to about 15 per cent. Consequently, there would be some little reduction of hill-climbing capacity, but experience has already shown that this is not very important. On most of the routes already being covered the physical conditions are not by any means of the most favourable character. On the contrary, they may be described as being of more than average severity. Whatever may be said as to the small scale and makeshift character of these experiments, the facts remain that a daily chars-a-banc service from London to Eastbourne and back is being maintained by this means; that the Bath Tramways have adopted this expedient on one or two of the routes covered by their vehicles, and that Walsall Corporation and others have decided to make essays in this direction. This is sufficient testimony to, at all events, the emergency value of coal gas fuel as applied to internal combustion road vehicles. As regards its possible future utility, it would be difficult to venture any prophecy. But the expedient of using high pressure instead of low, and thus of substituting more compact rigid containers for the flexible "balloons" now carried obviously suggests itself. Compressed gas was used for the engines on the cars of Blackpool and Lytham Tramways many years ago. In any case, inventive effort having been attracted to this problem, no one can say conclusively what are the limits of development arising therefrom.

## THE MOTOR TRANSPORT YEAR BOOK.*

We have received the second annual volume of this useful publication. In arrangement and style of get-up it bears a close resemblance to its older, better known, and much bulkier companion, "Garcke's Manual of Electrical Undertakings," which has proved a boon and a blessing to the industries concerned for many years. The book is designed to meet the need for a financial and descriptive record. It contains information relating to 374 companies and corporations authorised to engage in motor transport business in Great Britain. In the first volume the number was 350. There has also been an increase from 300 to 314 in the number of manufacturing firms dealt with. These increases are not so much indications of growth within the industry as of the greater availability of information about existing undertakings. Indeed, in the circumstances arising out of the present war, no great growth in the industry can be looked for, but after the war the development should be all the more rapid.

The book opens with an introduction and general survey in a series of valuable articles. Then follow the sections containing the records and data as to, first, motor transport undertakings, and second, manufacturing concerns. A geographical index gives the names of the undertakings according to the districts served, no fewer than 669 districts being named as compared with 560 last year. Finally we have the directory containing the names and addresses of over 2,000 directors and officials. Thus we have a comprehensive, well-thought-out plan executed in the way which might be expected from the Electrical Press.

A few interesting aggregate figures may be quoted. The issued capital of the undertakings included in Section 1, including expenditure by private concerns and by corporations on motor omnibus account, is over £11,620,000, as compared with £7,500,000 last year. The number of vehicles is 9,320, as compared with 6,300. The issued capital of the manufacturing firms is £32,220,000.

Among the articles in the volume is "Public Service Motor Policy in 1917," which discusses difficulties surrounding the immediate outlook. The law relating to motor omnibus services, the constitution and powers of the Road Board, and war-time restrictions in connection with lights on vehicles, are other subjects dealt with.

It may be noted in conclusion that railless trolley undertakings are included in the book, and that all concerned in passenger transportation by means of motor vehicles on roads will find the volume exceedingly useful.

York Electric Omnibuses.—In their report for the year ended March 31 the Tramways Committee state that the omnibuses ran 77,059 miles, carrying 642,943 passengers. The receipts were £2,571 19s. and the receipts per mile 8·01d. During the year the charge for electricity amounted to £737, whereas if the vehicles had been operated by petrol the cost would have been over £1,000. In wet weather, at week-ends, and at times of rush traffic some disadvantage has been found by intended passengers having to be left behind owing to the limited carrying capacity of the omnibuses, particularly in the case of the Burton Stone Lane traffic. The Tramways Committee have recommended the purchase of an additional omnibus.

* The Motor Transport Year Book and Directory, including public service undertakings and allied manufacturing companies, and a directory of officials connected therewith. Vol. II., 1917. 10s. 6d. net. London: Electrical Press, Limited, 13-16, Fisher Street, Southampton Row, W.C.

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## ARMY MOTOR SPECIFICATIONS OF THE UNITED STATES.*

PLANS THAT WILL ENABLE MAKERS TO CHANGE RAPIDLY FROM COMMERCIAL TO MILITARY MODELS.

SPECIFICATION FOR 1½-TON VEHICLES.

144. *Lighting Equipment.*—The truck shall be provided with the following lighting equipment :—

One searchlight, with quick-acting vertical and horizontal adjustment, silver-plated brass or copper parabolic reflector, or glass parabolic reflector silvered on the back, with 21-c.p. tungsten focussing bulb.

Two side lamps, combination oil and electric, with 8-c.p. 6-8 volt tungsten bulbs.

One electric instrument lamp, with 2-c.p. 4-volt bulb, and one combination oil and electric tail lamp with 2-c.p. bulb, connected in series.

One portable trouble lamp, 8-c.p., with cord, and plug with separate socket.

One ammeter of best make, for indicating the charge and discharge of battery.

145. *Searchlight.*—The searchlight shall be not less than 10½ in. in diameter outside of front flange. The body of lamp shall be spun or pressed from one piece of heavy brass, copper, or steel. In the design of the lamp no parts shall be used which are liable to shake loose from vibration. The reflector shall be parabolic in form, spun or pressed from brass or copper of suitable thickness, and heavily silver-plated. The reflector may be of glass, silvered on the back. The searchlight shall be of dustproof construction.

146. The searchlight shall be provided with a suitable handle, and means for clamping the searchlight securely in any desired position. The searchlight shall be installed on the chassis in a location permitting it to be readily operated from the driver's seat, and also in such a position as to be unobstructed from the front.

147. This lamp shall be provided with a single point bayonet socket, with two wire connections, and a suitable focussing device.

148. *Side Lamps.*—The two side lamps shall be best quality combination oil and electric, of suitable design and construction, and fitted with standard S.A.E. single point, grounded return sockets, and 15-c.p. 6-8 volt tungsten bulbs. The oil fonts shall be so designed that they cannot rattle or drop out. These lamps shall be made of heavy gauge sheet steel or brass, thoroughly rivetted and soldered, fully black enamelled, and fitted with forged steel yoke brackets or installed in dash. They shall have large glass semaphore front lens.

149. The instrument light socket shall be the single point type, with two terminals for wires. One terminal will connect with source of current supply, and the other will connect with a wire leading to the one point grounded tail light socket, thus putting the instrument light and tail light in series.

150. *Tail Lamp.*—The tail lamp shall be the same as specified for side lamps, except that the large semaphore lens shall be of red glass coloured in the glass composition, and the side glass may be omitted. The bulb shall be 2-c.p. 4 volt, connected in series with bulb of the same size and rating in instrument lamp. The tail lamp bracket shall be made of forged steel, and shall be located in such a position as to prevent it from being knocked off due to collision, or to the rear wheels of truck dropping into deep ditches.

151. *Trouble Lamp.*—The portable trouble lamp shall consist of a suitable hardwood handle through which the cord shall pass, and provided with an S.A.E. standard, single contact socket, with two connections for wires, a lamp guard of proper design, and an 8-c.p. 6-8 volt tungsten bulb. The other end of cord shall be provided with a suitable single point combination plug for connecting with a ground return socket. The cord shall be No. 14 B & S gauge, flexible, twin-conductor, rubber covered, double braided, packing house cord of best make. The portable trouble lamp shall be provided with an S.A.E. standard, single point, flush type, flanged socket, installed in a readily-accessible location, preferably on the dash, and connected with the lighting switch.

152. *Ammeter.*—Furnish and instal in a suitable location a flush type ammeter of best make, having a double scale for indicating the charge and discharge current of battery, and provided with a black dial bearing white figures. It shall be installed in such a location as will permit it to be readily observed from the driver's seat, and properly illuminated by the instrument light.

153. This ammeter shall be connected in the circuit leading from the negative terminal of battery. The ammeter must be so designed as to not be affected by severe vibration. It must have a light moving system, and be dead beat in action. It must be thoroughly insulated, and be so designed as to avoid short circuits due to the loosening of parts.

154. *Extra Lamp Bulbs.*—The following extra lamp bulbs shall be provided, installed in a suitable metal case :—

Two 21-c.p. 6-8 volt tungsten bulbs of best make, with single point Ediswan bases.

Four 8-c.p. 6-8 volt tungsten bulbs of best make, with single point Ediswan bases.

Two 2-c.p. 4 volt tungsten bulbs of best make, with single point Ediswan bases.

155. The bulb case shall be of heavy seamless steel, with a heavy seamless steel hinged cover with automatic spring catch. The bulbs shall be held securely in place by means of brass springs and a suitable locking device. The case must be of proper size to hold the above lamps without the lamps touching each other or the sides, top, or bottom of the case. The case shall be thoroughly coated, both inside and outside, with best quality black enamel.

156. *Wiring.*—The trucks shall be wired with the system of installation known as the ground-return system. In this system of wiring the chassis frame or bare metal is used as the return circuit. All ignition wiring must be protected from water and oil, and mounted in such a manner as to prevent chafing.

157. All wiring and electrical equipment shall be constructed, installed, and tested, in accordance with S.A.E. recommended practice.

158. *Conduit.*—Whenever practicable the wires shall be carried in either rigid or flexible metallic conduit. The flexible conduit is preferred. The conduit shall be securely fastened by means of galvanised straps and galvanised machine screws of proper size. The ends of the conduit must point downward, so that water will not run into the conduit.

159. *Cleats.*—Where wires are not protected with conduit they shall be securely cleated at intervals of not more than 10 inches. Such cleats shall be of galvanised steel of proper thickness and width, and secured with suitable screws. Galvanised steel machine screws in tapped holes shall be used in all cases where the fastening is to be made on metal.

160. *Fuse Box.*—A four-circuit fuse box of proper design shall be installed in a readily-accessible location.

161. The fuse box shall be of best make, and constructed of moulded insulating material in both box and cover, or the box and cover may be of black enamelled steel suitably lined with a proper insulating material. The wires shall all enter the fuse box from below, and be a snug fit in the opening in box. If steel boxes are used the holes in the box where wires enter shall have suitable insulating bushings, and the fuse clips must be mounted on a base of suitable insulating material, securely fastened to back of box by suitable brass screws. The heads of screws shall be deeply countersunk below the surface of the base.

162. *Extra Fuses.*—One complete set of extra fuses will be provided and attached by means of suitable spring clips to the inside of fuse box cover.

163. *Circuit Breaker.*—If a circuit breaker of an approved type is installed, the fuses herein specified will not be required.

164. *Switches.*—The ignition switch shall be a triple-point switch of best make, with one point for battery ignition, one point for magneto ignition, and the other point for cutting out the high-tension magneto by grounding.

165. The lighting switches shall be the push or pull type of flush switch of best make, mounted in a location readily reached from the driver's seat, and provided with a heavy brass gang switch-plate, in dead black finish.

166. *Grounding.*—Whenever an insulated conductor is connected to "ground," the connection shall be installed so as to be readily accessible and removable on the completed truck. In all cases where the connection is made to an iron or steel part, the iron or steel shall be thoroughly tinned at the point where the connection is made, and the ground connection shall be firmly maintained by means of screws or bolts with suitable lock washers. Brass or copper lugs of proper size shall be used for all ground connections. The lugs shall be properly soldered to the ends of cables.

167. All cables shall be continuous from connection to connection. The splicing of cables will not be permitted. All cables shall be provided with suitable lugs or terminals wherever practicable. Where

* *Continued from p. 397.*

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the use of terminals is not practicable, the ends of cables shall be tightly twisted, formed into a solid loop of proper size for the screw connection, and the loop thoroughly soldered.

168. *Battery.*—Furnish and instal on the truck a 100-ampere hour, 3-cell lead acid battery of best make, for ignition and lighting only, or a 75-ampere hour, 5-cell, nickel-steel, alkali battery of best make, at the option of the Government.

169. The battery shall be installed in a heavy pressed steel case, with waterproof hinged cover with latch. The inside of case must be 6½ in. wide, 16¾ in. long, and 9⅝ in. high.

170. *Battery Terminals.*—The battery terminals and connections must be so arranged as to prevent the possibility of the battery connections being reversed in relation to the generator terminals.

171. *Spark Plugs.*—The spark plugs shall be constructed in accordance with the latest recommendations of the Society of Automotive Engineers, and the large hexagon type of shell provided with a single sparking point shall be used. The spark-plug threads shall be ⅞ in., 18 threads to the inch.

172. The plug must be provided with a porcelain of best make, packed with suitable copper gaskets and held in place with proper bushings.

173. The centre electrode shall be made of metal which will not readily corrode, warp, or be burned by the hot gases, and must be packed thoroughly gas-tight inside of the porcelain.

174. The ends of the high-tension cable at spark plugs must be provided with suitable terminal properly secured to the cable and spark-plug terminals.

175. The seat for spark-plug gaskets shall be finished to a smooth and plain surface, and the seat shall be at right angles to the centre line of spark plug.

### Frame and Body.

176. *Frame.*—The frame shall be constructed of pressed steel or standard rolled structural sections. The frame and suspension must be so designed as to prevent cramping of any part, due to distortion of frame because of uneven road condition.

177. The distance from the back of the driver's seat to the rear end of frame shall be 10 feet. This frame length will permit of sufficient overhang of body to allow the installation of towing hooks and rear bumpers.

178. The frame shall be reinforced at proper intervals with suitable cross members thoroughly fastened to the frame with hot rivets or fitted bolts rivetted over nuts. All holes in the frame shall be drilled, not punched. A suitable towing hook shall be attached to each side of the front end of frame. These towing hooks may be installed on the front bumper.

179. The frame shall be provided with two best quality dressed oak sills, one bolted on top of each frame side member. These sills shall be the same width as the flange on frame, and shall be of proper depth to give not less than five inches clearance between the rear tires and the side sill of body, as shown on drawing Q.M.G.O. T-105. These sills shall be gained over all gusset plates or other irregularities on the frame, and shall be provided with not less than ten sets of body sill fastenings, as shown on drawing Q.M.G.O. T-107, and two angle plates with bolts, as shown on drawing of body. The sills shall be painted with three coats of paint of the composition given on drawing.

180. *Front Bumper.*—A spring type of front bumper of suitable design and construction shall be provided, and properly bolted to the front of frame. This bumper must be so arranged as to not interfere with the starting crank. Front towing hooks shall be provided, one at each side of the frame. These towing hooks may be fastened to the front bumper, if arranged in an approved manner. No part of the bumper extending in front of the radiator shall be integral with the chassis frame.

181. *Rear Bumper.*—A rear bumper shall be provided, as shown in detail on drawing T-102.

182. *Radiator Protectors.*—Each truck shall be provided with an effective radiator protector, which shall extend the full height and width of the radiator. This radiator protector shall be constructed of heavy structural steel shapes or steel castings, and shall be firmly bolted to the chassis frame. It must be so installed as to not interfere with the starting crank. Complete detail drawings, showing the construction of this protector, must be submitted.

183. *Steering Gear and Wheels.*—The steering gear may be either the worm and wheel type or the screw and nut type, and means shall be provided for its thorough lubrication. Adjustments must be possible without removing the steering assembly from the frame.

184. A notched grip moisture-proof steering wheel of best quality shall be provided, having an outside diameter of not less than twenty inches. The steering post must be rigidly mounted to prevent vibration, and must be provided with both spark advance and throttle levers.

185. The gear reduction and length of levers on steering gear must be such as to give easy turning action with the fully loaded truck, but the gear reduction must not be so low as to prevent sufficiently quick turning of the wheels in steering.

186. The ratio of movement between the steering hand wheel and the front road wheels shall be such that for 360 degrees travel of the steering wheel the road wheels will move not more than 40 degrees, and not less than 30 degrees about the steering angle pivot for two-wheel steer.

187. Throughout the steering gear, including all steering connection joints, adequate provision must be made for lubrication.

188. *Steering Connections.*—The steering knuckle tie rod, steering knuckle arms, and steering gear connecting rod must be located back of the axle in order that the front axle may protect them against damage from obstructions. The steering knuckle tie rod must be straight from end to end, and located as far above the lower edge of axle as possible, and entirely protected by the axle from spring seat to spring seat.

189. All steering connecting rod joints shall be hardened steel sockets, held by springs in close contact with hardened steel balls. The steering cross rod joints may be of the ball and socket or clevis type.

190. *Location of Control.*—The gear shift and hand brake levers must be placed at the driver's right, with the hand brake lever to the right of the gear shift lever. The hand brake lever is to be pulled back for brake application. The gear shift lever must be fitted with a latch guarding the reverse position.

191. *Gearshift Lever Handle Positions.*—The gearshift lever handle positions shall be as follows :—

| | | |
|---|---|---|
| First speed | ... | Forward and left. |
| Second speed | ... | Rear and left. |
| Third speed | ... | Forward and right. |
| Fourth speed | ... | Rear and right. |
| Reverse | ... | Guarded by a latch in separate gate. Extreme left through neutral, then forward. |

192. *Clutch and Brake Pedal.*—The clutch pedal should be located to the left, and the foot brake pedal to the right of the fore and aft centre line of the steering column.

193. *Accelerator Pedal.*—The accelerator pedal shall be placed to the right of the brake.

194. *Spark and Throttle Hand Levers.*—The spark and throttle hand levers shall be located to the right of the fore and aft centre line of the steering column. The spark lever shall be the shorter of the two, and both levers carried on stationary sectors. The words "Spark" and "Throttle" are to be clearly marked on the levers. Both levers shall be arranged so that they are pushed forward to advance the spark and to open the throttle.

195. The spark and throttle sectors shall be marked to indicate the open and closed positions of throttle, and advance, retard, and battery starting positions of spark.

196. *Data Plate.*—A suitable data plate must be installed in a readily observable location. The data on the plate must include the following :—

| | | | |
|---|---|---|---|
| Normal load capacity, pounds | ... | ... | 3,000 |
| Maximum speed, miles per hour | ... | ... | 15 |
| Serial number of motor | ... | ... | ... |
| Serial number of chassis | ... | ... | ... |

197. *Seat and Top.*—The trucks will be provided with seat and top shown on drawing Q.M.G.O. No. T-106.

198. *Fenders.*—The trucks must be provided with front fenders only. These fenders must be of suitable design and rigid in construction.

199. *Bodies.*—Bodies are not to be furnished unless specifically called for. The construction of chassis shall be such as to permit the proper installation of body on same, having inside dimensions of 5 ft. 1 in. wide, 10 ft. long, and 2 ft. high, with the floor of body at a height of not over 45 in. above the ground when the truck is loaded. The length of frame back of driver's seat shall be 10 ft.

200. In fastening the body to chassis, neither the frame nor the frame members shall be drilled, except the fastening for angle plate shown on drawing Q.M.G.O. No. T-105. The body shall be fastened to the frame by means of suitable bolts, as shown on drawing T-107.

201. *Painting.*—The entire chassis shall be first thoroughly cleaned of all dirt, grease, or oil, and covered with a coat of best quality rust-resisting paint. It shall then be painted with three coats of best quality lead and oil, olive drab colour, of the following composition :—

6 lb. white lead ground in linseed oil.
1 lb. raw umber.
1 pint turpentine.
½ pint japan drier.
1 quart linseed oil.

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202. Each coat must be permitted to become thoroughly dry before applying the next coat.

TRANSMISSION AND RUNNING GEAR.

203. *Clutch.*—The clutch may be either dry multiple disc or dry single disc type, having one series of plates faced with wire asbestos friction material. It must be of suitable design for transmitting the maximum torque of the engine without slipping, must be easily accessible for repair or replacement of parts, and must be provided with a suitable arrangement for permitting easy engagement which will not require frequent adjustment or renewal of friction material.

204. Flanges must be fitted on the clutch pedal in order to prevent the driver's feet from slipping off same. The pressure on the clutch pedal pad necessary to disengage the clutch must be not more than 90 pounds nor less than 70 pounds.

205. The clutch must be readily adjustable or provided with a spring which will give uniform action of the clutch during the wearing life of the friction material.

206. The clutch must be readily removable without disturbing the transmission, steering gear, motor, or other important parts, and must be provided with an effective clutch brake.

207. The clutch must be completely enclosed in order to prevent the entrance of dust, oil, or water.

208. The steel clutch discs must be properly hardened, and those without ring friction facing to be ground to a smooth surface.

209. All thrusts must be self-contained when the clutch is engaged.

210. The clutch release must be fitted with ball bearings, with adequate provision for lubrication. Plain clutch thrust bearings will not be acceptable.

211. *Transmission Drive Shaft.*—The transmission drive shaft, connecting clutch with transmission, must be provided with two universal joints of the lubricated bearing type. The fabric type of joint will not be acceptable. The joints must be entirely enclosed, and means provided for suitable lubrication and for retaining the lubricant in the joint. Provision must be made to prevent the shaft, whipping loose in the event of joint failure.

212. *Transmission.*—The transmission shall be of the selective sliding gear type, and must have not less than four speeds forward and one reverse, and must be installed as a separate unit on a subframe between the engine and differential. It must be installed with a three-point mounting in order to prevent the distortion of frame from breaking the transmission legs. The high-speed gear shall be direct without reduction in the transmission unless the truck is four-wheel drive.

213. The gears of transmission must be cut on suitable gear shapers or gear generating machine, from forged steel blanks of alloy steel equal to S.A.E. specification Nos. 2320, 3120, or 3320, properly case-hardened and accurately assembled to a quiet running fit under load. These gears must have sufficient width of face and strength to transmit the full power of the engine at all gear ratios, with a proper factor of safety.

214. The splined driving shaft for sliding gears must be made of best quality alloy steel, properly heat-treated.

215. The low gear ratio of transmission shall be suitable for giving a tractive factor of not less than ·338, as required by paragraph 30, and the total low gear reduction of transmission and final drive shall be not less than 40 to 1.

216. The transmission case must be oil-tight, and must be provided with a filler plug on the top or side, a suitable drain plug on the bottom, and an oil level plug on the side of case.

217. The main drive shaft, and also the countershaft of transmission, must all be provided with ball or roller bearings of best make and suitable capacity. The use of plain bearings in the transmission assembly will not be permitted, except in the case of the reverse gear. If the bearings are adjustable, the adjustment must be accomplished by the use of shims.

218. The transmission must be accessible from below the body for inspection, adjustment, removal, or repair. Transmission gears constructed as an integral part of the rear axle, or in any other manner which does not provide proper spring suspension, will not be acceptable.

219. *Propeller Shaft.*—The propeller shaft connecting the transmission with the rear axle and differential must be of suitable size and strength to properly transmit the full power of the engine at all gear ratios, under the most severe service conditions. It must also be of such design, and must be supported in such a manner, as to prevent whipping or excessive vibration at all reasonable coasting speeds. The slip joint shall be fitted with an S.A.E. standard or similar spline connection.

220. *Slip Joint.*—The slip joint for lower end of propeller shaft must be provided with S.A.E. standard splines, and must be designed in such a manner as to prevent the formation of a shoulder on the inside of joint. This slip joint must also be provided with a suitable tight-fitting leather boot which will prevent the entrance of dust or water.

221. Suitable provision must be made for preventing the propeller shaft from whipping loose in case of failure of the front universal joint.

222. Two universal joints must be provided between the transmission and differential. These universal joints must be so designed as to contain a proper quantity of lubricating grease, and must each be provided with a tight leather boot of best quality, first cut leather. The use of fabric universal joints will not be permitted.

223. The leather boots specified must be provided irrespective of the type of universal joint which is employed, and must be provided at each end of boot with suitable screw clamps.

224. *Drive Axle.*—The trucks may be either internal gear drive, chain drive, worm gear drive, or double reduction gear in a central housing. The driving axle may be either full-floating or semi-floating type.

225. The design, material, and construction of the drive axle and final drive shall be in every respect in accordance with the best standard practice.

226. *Driving Axle Bearings.*—The driving axle must be provided with suitable solid steel taper roller or two-point ball bearings of best make. All bearings must be provided with suitable means for lubrication and for retaining the lubricant in the bearings. All thrusts must be compensated for by adjustable ball or roller bearings. The plain type of thrust bearing or three-point ball bearings will not be permitted.

227. The rear axle housing must be oil-tight, and must have an inspection plate giving ready access to the inside of housing. An oil filler plug must be provided at a proper height to act as an overflow in filling. If the oil filler plug is located in the inspection plate, the studs for holding the plate must be so arranged as to prevent the plate from being reversed. The differential complete must be readily removable after removing the splined drive shafts.

228. [Omitted for reason stated on page 393, June 9, 1917.]

229. *Differential.*—The differential shall be of such a type as to automatically permit the wheels to revolve at different speeds without complete loss of torque on either wheel, and also to apply at least normal torque to whichever wheel shall have traction. These requirements shall be met when the vehicle is running either forward or backward.

230. It shall consist of a forged steel or cast steel case, to which the large gear is attached by being bolted or rivetted. This case shall also contain the necessary gears for producing the required differential action, and shall be provided with suitable steel roller or ball bearings of best make. The case shall be supported on its bearings independent of the drive shaft ends. The drive shaft ends shall be properly fitted and connected by means of suitable splines to the gears in differential case. The spline connection shall be made in accordance with S.A.E. standards.

231. All steel differential or driving gears shall be machine cut on suitable gear generators, from forged blanks of S.A.E. steel Nos. 2320, 3120, or equal, and properly heat-treated.

232. The bevel drive pinion shall be forged integral with its shaft. This shaft shall be made of steel equal to S.A.E. specification No. X3335, properly heat-treated, and provided with two sets of taper roller or ball bearings of best make, and provided with suitable means for the ready adjustment of the bevel driving pinion in relation to the large driven gear, and *vice versa*. If ball bearings are used, suitable means shall be provided to take care of thrust loads.

233. *Worm or Bevel Gear Drive.*—If the rear axle is of the worm or bevel gear driven type, it may be a built-up structure using steel tubes pressed or shrunk into a properly ribbed cast-steel or malleable iron housing, or a suitable one-piece cast-steel or malleable iron axle housing may be used without any steel tubes. Truss rods may be used at the discretion of the constructor, but the factor of safety of the rear axle load carrying assembly or member must be large enough to preclude any likelihood of breakage under the most severe service conditions.

234. *Internal Gear Drive.*—If the final drive is an internal gear, provision must be made for entirely enclosing the driving gears, and for retaining the lubricating oil or grease, and for preventing same from getting on to the brake bands.

235. Both the spur driving pinion and the internal gear shall be machine cut from drop forged steel blanks. The internal gear ring may be made of carbon steel equal to S.A.E. specification No. 1020, properly heat-treated for the purpose, but the spur driving pinion

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must be made of steel equal to S.A.E. specification Nos. 2320, 3120, or 3320, suitably case-hardened. Both gears must have wide faces and must be so designed and constructed as to readily withstand the maximum power of the engine under the most severe service conditions, with a proper factor of safety.

236. All gears connected with this drive must be heat-treated in the most suitable manner. The internal gear must be pressed on to turned flange on the wheel hub, and then firmly secured with suitable rivets.

237. The jack shafts shall be made of best quality chromium-nickel steel equal to S.A.E. specifications Nos. 3140 or X3325, must be properly splined at each end for connecting with driving gear and differential, and shall be provided at each end with steel roller or annular ball bearings of best quality. These jack shafts shall be enclosed in steel tubing having flexible end connections in both the differential housing and the internal gear case, and these flexible connections shall be provided with suitable felt washers.

238. The wheel spindles shall be made of best quality chromium-vanadium steel equal to S.A.E. specification, No. 6135, properly heat-treated.

239. *Front Axle.*—The front axle shall be of I-beam section, drop forged from a single piece of carbon steel or alloy steel equal to S.A.E. steel No. 1035, and properly heat-treated. The steering knuckles and the steering knuckle levers shall be drop forged from alloy steel equal to S.A.E. steel Nos. 2330, 3130, or 3325, and properly heat-treated. The wheel spindles shall be provided with steel roller bearings of best quality, and provided with proper means of lubrication. The wheel hubs and bearings of both front and rear axles must be so designed as to prevent the entrance of water, dust, or dirt, and also must prevent the leakage of grease from the hubs.

240. *Brakes.*—Two independent sets of double-acting brakes shall be provided. The emergency brake must act directly on the rear wheels, and be operated by a hand lever with ratchet. Service brakes may act directly on the rear wheels or on the drive shaft, and must be operated by a pedal. Brakes must be lined with an approved friction material, and must be so constructed that they may be readily adjusted and securely locked in adjustment without removing the wheels or other parts.

241. Suitable flanges must be fitted on the brake pedal to prevent the driver's foot from slipping off same.

242. Brake rods are to be sufficiently stiff or so supported as to prevent whipping or rattling.

243. Brakes must be sufficiently powerful either to slip the wheels or stop the truck within a distance of not more than fifty feet, with either the service brakes or the emergency brakes, when the normally loaded truck is running on a level, hard, and dry macadam road at a speed of 15 miles per hour.

244. The service brakes may act directly on the drive wheel, brake drums, or on the driving axle next to the propeller shaft.

245. Brake adjustments must be readily accessible, and must be adjustable without the use of special tools. All brake clevises, pins, or other bearings in brake rods or brake connection must be provided with bronze bushings.

246. The design of brakes and brake connections must be such that the application of drive wheel brakes is not affected by relative movement between the frame and axle.

247. Both the service brakes and the emergency brakes must be readily adjustable for taking up wear, and must be provided with as large an amount of radiating surface as practicable. Provision must also be made for holding the braking surfaces on brake bands or brake shoes concentric with the brake drum surface. The brakes must be so designed as to release completely and not drag at any point when the brake lever or pedal is released. The brake drums must be exactly circular, and the central opening in same fitted over a finished boss on the wheel hub, or other method equally effective which will retain the brake drum must be fastened to the wheel with suitable tight-fitting bolts. Provision must also be made for preventing oil or grease from leaking out of the axle or drive shaft ends and getting on to the brake bands and drums.

248. All brakes must be mounted in such a manner that the braking strains will be taken by parts which are strong enough to withstand these strains under the most severe braking conditions.

249. *Wheels.*—The wheels shall be of suitable size for the use of 36-in. S.A.E. demountable solid tires, and shall be best quality cast-steel wheels, of proper design, strength, and construction, and made in accordance with the best standard practice.

250. The wheels shall be of suitable size and design for the use of 36-in. × 4-in. single solid S.A.E. demountable rubber tires on front wheels, and 36-in. × 7-in. single solid S.A.E. demountable tires on rear wheels. All wheels shall be of proper strength to resist the vertical and lateral loads in the most severe service, and with the maximum load and speeds for which the truck was constructed.

251. The hubs of wheels shall be made of best quality cast or forged steel, free from blow holes which will impair the strength or finish of finished hub, and must be provided with best quality hardened and ground roller or annular ball bearings of proper size. The hubs may be integral with the wheel casting.

252. *Demountable Tire Fastenings.*—The steel fastenings for demountable tires shall be constructed in accordance with drawing Q.M.G.O. No. T-101. Trucks will positively not be accepted having tires or tire fastenings which differ from those herein specified.

253. *Tires.*—On two-wheel drive trucks the tires shall be 36-in. by 7-in. single tires on rear wheels, and 36-in. × 4-in. single tires on front wheels, both front and rear tires demountable.

254. On four-wheel drive trucks the tires shall be 36-in. × 6-in. single, demountable, both front and rear.

255. All tires shall be best quality solid rubber tires on hard rubber base, with S.A.E. steel rims. A sample section of the rubber tire and rim must be submitted with each proposal.

256. Complete detail and assembly drawings, showing the construction, material, and dimensions of all parts of the wheels must be submitted.

257. *Hub Odometer.*—A hub odometer of best make, and of suitable design and construction for most satisfactory use on motor trucks, shall be provided and installed on one of the front wheels. This odometer shall have not less than five figures in the dial, and provision shall be made to prevent leakage of grease into mechanism.

SPRINGS.

258. *Springs.*—The chassis spring suspension must be of such design and construction as to relieve the body and chassis above springs of excessive vibration when the vehicle is travelling empty or partially loaded over rough surfaces at maximum speed.

259. Springs must be made of alloy steel, heat-treated to develop the following physical properties :—

| | |
|---|---|
| Minimum elastic limit ... | 170,000 lb. per square inch |
| Tensile strength, not less than | 210,000 lb. per square inch |
| Elongation, not less than ... ... | 5 per cent. in 8 in. |
| Brinell hardness ... ... ... ... ... | 390–470 |

Care must be exercised to prevent specimen from slipping in the grips and causing diagonal strains.

260. *Deflection of Springs.*—The deflection of rear springs shall be not more than 1,000 pounds per inch, and not less than 800 pounds per inch. The deflection of front springs shall be not more than 800 and not less than 550 pounds per inch. The maximum deflecgion permitted by the permanent stops, both front and rear, must be given.

261. Spring eyes must be provided with phosphor-bronze or soft steel bushings, pressed in and reamed in position to the S.A.E. limits of tolerance for such bushings. Bushings must have suitable lubricating channels, and conform to S.A.E. standard of wall thickness. If phosphor-bronze is used, it must be equal to S.A.E. specification No. 26.

262. Spring eye bolts must be hardened and ground to S.A.E. standard sizes and tolerances. Eye bolts must be securely anchored to prevent turning in the spring shackles, and be provided with suitable means for lubrication.

263. Spring shackle bolts or cross-bars must be properly hardened and ground on bearing surfaces, and be so designed as to provide at least equal projected bearing area to that provided by the eye bolts. Where shackle bolts are used in connection with bat shackles, they must be provided with suitable means of lubrication and be securely anchored to prevent turning in the shackle. The spring shackle bolts shall also be made to S.A.E. sizes and tolerances.

263a. *Spring Shackles.*—Spring shackles must be made of a material equal to S.A.E. specification No. 1235 for steel castings, and heat-treated. They must have a centre-to-centre distance not less than the spring width, and may be of two types—bar shackles formed of two plates with a connecting bar formed integral with them, or yoke shackles, having one end open and the other end connected and adapted to receive the shackle pin or bar. Where yoke shackles are used, they must be bushed at the shackle pin or bar end with a material equal to S.A.E. specification No. 26, or soft steel, bushing to have ⅛-in. walls, lubricating channels, and suitable means of lubrication. Yoke shackles must be so designed as to provide projected bearing area at the closed end at least equal to that of the spring eyes. Rear spring shackles must be in tension. Spring shackles or hangers must be so constructed as to prevent binding on the sides of the spring eyes or the supporting brackets.

264. *Shackle Hangers.*—Shackle hangers, when used in connection with bar shackles, must be bushed with a material equal to S.A.E. specification No. 26 or soft steel, said bushings to have ⅛-in. walls, and be provided with suitable lubricating channels and means of lubrication.

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265. *Shackle Position.*—In the design of springs and the assembly of same on chassis, the spring shackles must stand in approximately a vertical position when the spring is under full load, except on chain-driven vehicles, where shackles must stand at an angle sufficient to allow chain adjustment without cramping the spring main plates.

266. *Spring Leaves.*—Spring leaves must be held against longitudinal movement by means of an alloy steel centre bolt of proper size, by an indentation in the centre of each leaf, or by a combination of those methods. If centre bolts are used, the head shall conform to S.A.E. standard, and be provided with snug fitting S.A.E. standard centre bolt nuts and means provided for locking the nuts in position. Springs with shrunk-on centre bands will not be acceptable because of the difficulty of making repairs in field service. Centre fastening must be shown in detail on the drawing.

267. *Spring Clips.*—Spring clips must be made of alloy steel equal to S.A.E. No. 3130 or 3320, properly heat-treated, to develop physical properties equal to the following :—

| | |
|---|---|
| Elastic limit ... ... ... | 100,000 lb. per square inch |
| Tensile strength ... ... | 130,000 lb. per square inch |
| Elongation ... ... ... ... | 20 per cent. in 8 in. |
| Reduction of area ... ... ... | 60 per cent. in 8 in. |
| Brinell hardness ... ... ... ... ... ... | 295 |
| Scleroscope ... ... ... ... ... ... ... | 35 |

268. Spring clips must be constructed in accordance with S.A.E. standards. The chemical specifications, physical properties, and heat treatment must be given. The use of carbon steel spring clips will not be permitted. Nuts may be of carbon steel.

269. *Metal Spring Chairs.*—Metal spring chairs must be provided between springs and spring seats. Chairs must be so designed as to be held by the spring clips against longitudinal movement, and have one face shaped to conform to the shape of the spring when the spring is free or without load. The centre of the chair must be recessed to properly receive the centre fastening of the spring. Spring chairs may be omitted where the spring seat is shaped to conform to the shape of the spring when the spring is free.

270. *Pressure Blocks.*—Pressure blocks, of a material equal to S.A.E. specification No. 1235 for steel castings, heat-treated, must be provided between the spring clips and the spring, and must be grooved and conform to the shape of the spring clips where in contact with the clips. The face of pressure blocks must conform to the shape of the spring when the spring is free.

271. *Permanent Stops.*—All vehicles must be provided with permanent stops which will prevent the springs from being deflected to a point at which the stress will be greater than 75 per cent. of the elastic limit of the material from which the springs are made. Suitable rubber or steel buffers must also be provided for both front and rear springs.

272. *Rebound Clip.*—A suitable number of rebound clips must be provided on each spring, and attached in such manner as to retain their proper position. These rebound clips must be constructed in accordance with S.A.E. recommended practice.

273. *Lubrication.*—The lubrication of all spring connections must be through grease or oil cups, which must be so located as to be readily accessible and of ample capacity, and so designed as to prevent any part of the cup shaking loose through vibration. When cups are not formed integral with the spring connections, they must be screwed in position with standard ¼-in. taper pipe thread ; at least four threads of shank must be engaged.

274. *Retaining Alignment.*—Springs must be provided with suitable means for retaining the leaves in proper alignment with each other. The method used must be shown in the drawing.

275. Scale formed on leaves during heat treatment shall be removed as thoroughly as possible without breaking surface skin.

276. All springs must be constructed and tested in accordance with S.A.E. standards and recommended practice, and must comply with these requirements.

277. *Driving Thrust and Torque.*—The driving thrust and torque may be transmitted through radius rods, the torque may be taken through torque arms, or the springs may be designed to take either or both torque and thrust.

278. If power or torque is transmitted through the chassis springs, the design must be such that the vehicle will not be rendered inoperative through breakage of the main or driving leaf of the spring, and the axle attachment must be such as to prevent relative longitudinal movement of the spring on its seat.

## HOW SPECIFICATIONS FOR 3-TON TRUCKS DIFFER FROM THOSE OF 1½-TON VEHICLES.*

The specifications for 1½-ton trucks shall apply in the furnishing of 3-ton trucks, except in the following particulars. Numbers in brackets refer to paragraph numbers in the 1½-ton truck specifications.

1. (24) *Load Capacity.*—The trucks must be of sufficient strength, and provided with sufficient power, to carry and propel the following gross load under the most severe service conditions :—

| | |
|---|---|
| Pay load ... ... ... ... ... ... | 6,000 lb. |
| Body ... ... ... ... ... ... | 1,500 lb. |
| Three men... ... ... ... ... ... | 525 lb. |
| Extra equipment ... ... ... ... | 200 lb. |
| | 8,225 lb. |

The extremely severe service conditions under which these trucks will be operated indicate that they should be designed for a nominal pay load of 7,000 to 8,000 pounds.

2. (26) *Weight of Chassis.*—The maximum weight of chassis, without body or extra tool and parts equipment, and without gasoline, water, or oil, must be not more than 8,000 pounds. A definite statement must be made showing exactly what equipment is included in the stated weight.

3. (32) *Wheelbase.*—The wheelbase must be suitable for the use of a 12-ft. body, and shall be not less than 124 in. or more than 156 in.

4. (34) *Gauge.*—The gauge of wheels on 3-ton trucks, measured from centre to centre of fellow bands, shall be as follows :—

5-in. single front tires, 59½ to 64½ inches.
5-in. dual rear tires, 64½ inches.

5. (35) *Engine.*—The engine must be of the 4-cycle type, water-cooled, having not less than four cylinders, and provided with mechanically operated poppet valves. It shall have a total piston displacement of not less than 414 cubic inches, and must develop a torque of not less than 2,475 in.-pounds at not more than 1,000 feet of piston speed per minute. The torque at 500 feet of piston speed per minute shall be not less than 90 per cent. of the maximum torque. The engine must be under a removable hood, and located in a readily accessible position. The hood must be waterproof, readily removable without removing screws or bolts, and must open up sufficiently wide to permit of easy access to engine for inspection or adjustment. All main and connecting rod crank end bearings shall be so designed as to be easily adjusted to take up wear. The piston pin bearing shall consist of a suitable phosphor-bronze bushing properly secured in the connecting rod end. The valve stem guides and push rod guides shall not be as integral with the cylinder casting, but must be separate parts, properly secured in place. The lower half of the crank case must be removable without disturbing the main bearings or the clutch housing, or removing the engine from the chassis. The unit power plant type of construction will not be permitted. The transmission must be mounted as a separate unit.

6. (177) The distance from the back of the driver's seat to the rear end of frame shall be 11 ft. 11 in. This frame length will permit of sufficient overhang of body to allow the installation of towing hooks and rear bumpers.

7. (196) *Data Plate.*—A suitable data plate must be installed in a readily observable location. The data on the plate must include the following :—

| | |
|---|---|
| Normal load capacity, pounds ... ... ... | 6,000 |
| Maximum speed, miles per hour ... ... ... | 12 |
| Serial number of motor ... ... ... ... | —— |
| Serial number of chassis ... ... ... ... | —— |

8. (199) *Bodies.*—Bodies are not to be furnished unless specifically called for. The construction of chassis shall be such as to permit the proper installation of body on same, having inside dimensions of 6 ft. 6 in. wide, 12 ft. long, and 2 ft. high, with the floor of body at a height of not over 45 inches above the ground when the truck is loaded. The length of frame back of driver's seat shall be 11 ft. 11 in.

9. (215) The lower gear ratio of transmission shall be suitable for giving a tractive factor of not less than ·338, as required by paragraph 30, and the total low gear reduction of transmission and final drive shall be not less than 50 to 1.

10. (250).—The wheels shall be of suitable size and design for the use of 36-in. × 5-in. single solid S.A.E. demountable rubber tires on front wheels, and 36-in. × 5-in. dual solid S.A.E. demountable tires on rear wheels. All wheels shall be of proper strength to resist the vertical and lateral loads in the most severe service, and with the maximum load and speeds for which the truck was constructed.

11. (253) *Tires.*—On two-wheel drive trucks the tires shall be 36-in. × 5-in. dual tires on rear wheels, and 36-in. × 5-in. single tires on front wheels, both demountable.

12. (260) *Deflection of Springs.*—The deflection of rear springs shall be not more than 1,500 pounds per inch and not less than 1,000 pounds per inch. The deflection of front springs shall be not more than 900 and not less than 650 pounds per inch. The maximum deflection permitted by the permanent stops must be given.

* The standard specifications for 3-ton petrol motor trucks are published by the United States Government in the form of an appendix to the general specifications to indicate points of difference.



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## THE FUTURE OF THE BRITISH MOTOR INDUSTRY.

Mr. H. T. Vane, managing director of D. Napier and Son, Limited, manufacturers of the well-known Napier cars, has given his opinions to an interviewer on the subject of the future of the British motor industry. Mr. Vane has taken a leading part since the outbreak of war for the protection of the industry.

In the first place, Mr. Vane pointed out that it will be patent to everyone that the trade at present is entirely dislocated owing to the output of the various factories being taken by the Government for war purposes. The private trade has entirely "gone by the board," and naturally, with the private trade, all sales organisations and internal arrangements. It will be the first duty of the manufacturer when peace is in sight at once to reorganise the sales departments. This at first sight may seem a light task, but it will involve an immense amount of work and careful thought, and is intimately connected with post-war policy. This latter in itself is a problem of the first order, and has to be studied under the greatest difficulty.

Undoubtedly the British manufacturer has gained experience through war conditions, not only in regard to car manufacture, but especially in regard to aero engines, aeroplanes, and aircraft generally. Modern aero engine designs require a very high class of workmanship.

Mr. Vane continued :—A matter of great concern which faces the motor industry is the question of Government protection. Too much cannot be said about this, for whilst the leading manufacturers have been loyally aiding and supporting the Government, their private trade—upon which, after all, they depend -has disappeared, together with the huge overseas market, which is now supplied principally by America. What should be done ? It is obvious that the trade should be safeguarded for from three to five years after peace is declared in order to give the British manufacturer time to get going again in his legitimate trade. In the first place, the British manufacturer should be strongly protected by the Government in regard to the home market ; that is to say, a tariff or prohibition should be placed on all foreign-made cars, whilst we over here are putting our house in order. Second, steps should be taken by the Overseas Governments to place a tariff on imported cars outside British manufacture. America has up to now reaped enormous benefits through the British manufacturer being unable to supply the ever-increasing demand. While we should grant America more favourable terms than say, for example, enemy and neutral countries, this should be *pro rata* ; in other words, while a suitable tax should be placed upon imported vehicles from enemy and neutral countries, America should also pay a tax not less than that imposed by the Americans themselves on British manufactured motor cars prior to the outbreak of war. This should apply to vehicles imported both into Great Britain and the Overseas Dominions at the conclusion of peace. They have reaped the benefit of our inability to supply, and surely it is only fair that we, who have been engaged on war work from the outbreak of hostilities, should be strongly protected by the British Government.

In regard to the vast quantities of cars which are now in use on the various fronts, as to what will become of these after the war, and how they will affect future supplies, Mr. Vane pointed out that probably France, Belgium, Russia, and other Allies will require for internal use a large proportion of army vehicles, and the Government should take in hand at once the question of having these duly allocated. Assume for a moment that myriads of motor vehicles were returned to this country. It would mean a serious setback, to put it mildly, for the trade here, and he could not think that any British Government would subject any British trade to such a menace. The British manufacturers have put their views before the responsible authorities with urgency, and it is now for the Government to arrange for these views to be acted on. Every car or transport lorry should go back to its own factory for repairs and overhaul on agreed terms. It is suggested that the manufacturer should be given an agreed period to dispose of the vehicles, and when he sells, that he sells with a guarantee that the vehicles have been thoroughly overhauled and can be guaranteed to that effect. This arrangement would mean that the public would be supplied with a reliable vehicle from a home factory, and that would safeguard the public as well as the manufacturer's reputation. The motor trade is comparatively new, but it already employs thousands of skilled men -the sort that are the backbone of the nation—and they must be looked after by the Government.

Mr. Vane showed that he is by no means a pessimist. He is a strong believer in the development of motor transport, and also, incidentally, aerial travel and transport. The war, he said, had increased efficiency and output, and providing the industry is protected at the conclusion of hostilities, he has no fear whatever in regard to the future.

## TRAVEL BY AIR.

LORD MONTAGU'S SCHEME FOR ROUTES AND RULES.

Colonel Lord Montagu, advisory mechanical inspector to the Government of India, on June 21 lectured at the Central Hall, Westminster, on "The World's Air Routes and Their Regulations." There was a large audience of representatives of aviation and motor manufacturers, Government offices, and the Royal Flying Corps.

The British Empire, the lecturer remarked, was in a peculiarly favourable position for the development of Imperial aviation, for its widely-separated possessions would enable air traffic round the world to proceed without concessions from other nations. He assumed that the average speed of commercial flying would probably not much exceed 80 miles an hour for some time to come. The general principle which should underlie all regulations of air traffic was that slow-speed silenced planes should use the lower levels, and high-speed planes the upper levels of the air. Above the commercial levels he would have another zone of 2,000 feet—4,000 to 6,000 feet—for planes also silenced, capable of speeds between 80 and 120 miles an hour. This would include the general air traffic of the planet for ordinary flying, including a proportion of fast commercial machines. Levels above 10,000 ft. should be internationalised. The upper air should be free to all under certain regulations, provided that pilots complied with certain "rules of the road," and their craft passed as airworthy. The existence of alternate high and low pressure areas, with their respective and regular circulations of wind, would define far more than geographical conditions the chief air routes of the world.

The lecturer assumed that world-flying, as far as passenger services are concerned, would be arranged by stages and not be continuous, and he set out a time table of two routes to India, the southern route being as follows :- -

| | Miles. | | Time. |
|---|---|---|---|
| First Day. | — | Croydon (London) | dep. 7.0 a.m. |
| | 625 | Marseilles | arr. 12.30 noon<br>dep. 1.30 p.m. |
| | 485 | Naples | arr. 6.0 p.m. |
| | 1,110 | | |
| Second Day. | — | Naples | dep. 7.0 a.m. |
| | 640 | West Coast of Crete | arr. 12.15 noon<br>dep. 1.15 p.m. |
| | 485 | Alexandria | arr. 5.45 p.m. |
| | 1,125 | | |
| Third Day. | — | Alexandria | dep. 7.0 a.m. |
| | 580 | Jof | arr. 12.0 noon<br>dep. 1.0 p.m. |
| | 460 | Basra | arr. 5.0 p.m. |
| | 1,040 | | |
| Fourth Day. | — | Basra | dep. 7.0 a.m. |
| | 575 | Bandar Abbas | arr. 12.0 noon<br>dep. 1.0 p.m. |
| | 680 | Karachi | arr. 6.30 p.m |
| | 1,255 | | |

Total distance 4 530 miles.
39 hours 15 minutes actual flying time.
83 hours 30 minutes total time on journey.

In the time table referring to the second route from India—Peshawar to London—a distance of 3,630 miles, it was shown that the actual flying time would be thirty hours and fifteen minutes, and the total time on the journey 59 hours.

The three points of importance were :—(1) As soon as war is over there must be national and international laws for the regulation of flying ; (2) oversea and over-Continental routes must be defined in the interests of the whole world ; (3) the winds of the world, instead of being a drawback over the surface of the planet, would, if properly used, prove to be of great assistance. "The great development of flying," he added, "produced by this war, will mean that in a few years from now the human race will navigate the air with ease, speed, and safety."

ALBION MOTOR CAR COMPANY.—The net profits for 1916 were £57,174, and £19,347 was brought forward. A final dividend of 15 per cent. is proposed on the ordinary shares, making 20 per cent. for the year, adding £25,000 to the reserve, and carrying forward £17,663.

LONDON MOTOR VEHICLE REGISTRATIONS.—During the quarter ended March 31 the London County Council registered 1,436 motor cars, 467 heavy motor cars, and 865 motor cycles ; and licences to drive issued numbered 13,462. Under the Locomotives Act, six annual licences (five at £10 and one at £18), and 68 daily permits at 2s. 6d. each, were issued, and one agricultural locomotive has been registered during the quarter. In the corresponding quarter of 1916 motor car registrations totalled 2,210, heavy cars 552, motor cycles 1,405, and licences to drive 14,345.

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# MOTOR TRAFFIC.

## THORNYCROFT WAGONS ON HILL-CLIMBING TESTS.

The two illustrations given below are from photographs taken during the hill-climbing tests of a further batch of Thornycroft 3½-ton subsidy machines destined for service "somewhere in France." The scene of the test is the well-known Furley Hill on the Winchester Road, and at the point at which the photograph

Fig. 1.—Gradient 1 in 8.

(Fig. 1) was taken, this has a gradient of 1 in 8. As all the machines succeeded in climbing the entire hill on the third speed the result of the test gave further proof of the splendid pulling power of the Thornycroft subsidy engine.

Fig. 2.—On top.

The machines shown are the firm's 40-H.P., type "J," the entire output of which is being taken by the War Office for military service. Although at the moment Messrs. Thornycroft are unable to supply private customers, either at home or abroad, their clients may rest assured that all orders on their books will be executed as promptly as possible and in rotation.

EXETER COUNCIL have increased the allowance made to the Medical Officer for the upkeep and running of a car from £80 to £100 per annum.

## NEW PETROL DEPARTMENT.

The Board of Trade announced on June 26 that the duties hitherto performed by the Petrol Control Committee with regard to the distribution of petrol for civil and industrial needs will in future be performed by a Petrol Control Department of the Board of Trade. The President has appointed Sir Evan Jones, Bart., M.I.C.E., to be controller of the new department, Mr. P. G. L. Webb to be deputy controller, and Mr. H. W. Cole to be chief clerk. Sir Evan Jones will retain his position as Commissioner for Dyes.

The President of the Board of Trade has appointed Sir Walter Egerton, K.C.M.G., to be chairman of the Pool Board, which is responsible for co-ordinating the work of the various oil distributing companies.

### PLEASURE MOTORING ON SAVINGS.

In the House of Commons on June 29, Sir C. Johnston asked whether the Board of Trade had discovered the source of supply of petrol to a number of cars on pleasure excursions still to be seen upon the roads; and whether steps would be taken to stop this supply.

Mr. G. H. Roberts (Parliamentary secretary) replied: I am afraid it is the case that a certain number of persons still use motor cars for purposes which are not essential. The petrol for the purpose is obviously being obtained from savings from the restricted amounts authorised by the petrol licences.

Mr. Duncan Millar: Is any attempt being made to check the use of cars for pleasure purposes by stopping the cars on the road and ascertaining the uses to which they are being put?

Mr. Roberts: We aim at restricting the use of petrol by licence. Very severe restrictions have been imposed.

Mr. Millar: Is it not necessary to ascertain how cars are being used, and whether the conditions are being fulfilled?

Mr. Roberts: I think the most effective method is to restrict the supply.

## MOTOR VEHICLE INSURANCE.

In the course of his remarks at the annual meeting of the Eagle and British Dominions Insurance Company, on June 28, Mr. E. M. Mountain (chairman and managing director), who was enthusiastically received, remarked that he had had the pleasure of addressing the annual meeting for many years, but this was the first time as chairman. Dealing with motor insurance, he said that the lighting restrictions and the calling up of a very large number of experienced and skilled drivers caused a heavy increase in the number of claims, and the cost of settling claims had also been greatly increased for reasons similar to those to which he had already referred in connection with other departments. The restriction of petrol supplies had also affected to a large extent the best class of business transacted. These restrictions had, however, enabled the company to be the pioneers in offering to the public advantages which were not to be obtained elsewhere. They issued a prospectus showing a greatly reduced premium, in which full cover was offered to owners of private cars, whose licences had not been renewed. This the company found immediately supplied a want, and so great was the demand for the policy that they had now extended this scheme by issuing policies at premiums based on the amount of petrol allowed under licence to apply to holders of petrol licences.

## WAR WORK FOR MOTORS IN THE U.S.A.

At a war meeting in Washington on May 25, Mr. Howard Elliott, ex-president of the New York, Newhaven, and Hartford Railroad, and chairman of the Railroad Executive Committee, Council of National Defence, said that the United States had 250,000 miles of railroad, employing over two million men, yet the railroads were inadequate to produce sufficient transportation for the troops who were to be trained for the war and of the vast quantities of foodstuffs and munitions. It required a million a year to be spent on improvements. He exhorted wagon owners to unload freight cars promptly, and he also pointed out the great opportunity of the motor truck for short haul traffic in this time of national crisis. Motor vehicles would be the allies of the railroad instead of competitors, and would help them by relieving them of the unprofitable short haul work.

LINCOLN COUNCIL have purchased a Ford van for the breakdown gang of the Waterworks department and for other purposes.

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# MOTOR TRAFFIC.

## STRAKER-SQUIRE TIPPING WAGONS.

At first sight the accompanying illustration, representing a scene of municipal sanitary work in a typical London street, would hardly lead one to believe that the Straker-Squire 5-tonner in question is only getting some practice for the much harder work it is really intended for. The machine was constructed with a special Ruston hand tipping body for use by Les Forges d'Hennebont, France, for some very stern work of warlike nature behind the lines. The vehicle is one of a fleet which has preceded it, used for mending

Straker-Squire Tipping Wagon.

roads, filling up shell holes, and generally "paving the way" for a speedy return to its natural mechanical mission in life. In our issue of May 10 particulars were given of this type of machine, together with illustrations showing the special tipping body arranged both for end and side tipping.

## OMNIBUS BURDENS.

Reforms Suggested by the Chairman of the B.E.T. Company.

Presiding at the annual meeting of the British Electric Traction Company, Mr. E. Garcke referred to the serious difficulties with which motor omnibus proprietors are faced.

"This young business," he said, "has not received from the Government the recognition which it deserves, and every day the owners of onnibuses are finding it more and more difficult to satisfy the requirements of local and road authorities. There are two points which require settlement. The first is the question of licensing vehicles. To-day almost every borough and urban authority is empowered to make its own requirements. Omnibus services traversing routes 30 or 40 miles in length may be subject to the licensing conditions imposed by ten or twelve different local authorities. The second point is the contribution required from omnibus owners towards the maintenance of the roads. Before the war the Government recognised that money would have to be spent on improving the roads, and a tax was placed on petrol, the proceeds of which were to be used for the improvement of the roads, under the direction of the Road Board. Since the war the proceeds of this tax have been diverted into the Imperial Exchequer, with the result that the road authorities are all endeavouring in their own way to obtain contributions from those who are working omnibuses. In view of the fact that an omnibus in regular service contributes in the form of petrol tax £50 to £60 per annum, it does not seem reasonable that because the Government has appropriated the tax for national purposes the owners of omnibuses should be required by local authorities to contribute a second time."

"Shell" Transport and Trading Company.—The directors recommend a further dividend of 25 per cent. on ordinary shares, making 35 per cent., free of tax, for the year. The Treasury have granted the issue of one million £1 shares at par, and the directors have decided to offer them to shareholders in the proportion of one new share for every four now held. The dividend will be appropriated in payment. The dividend for each of the three preceding years amounted to 35 per cent. on ordinary shares, while 30 per cent. was paid for 1912.

## TECHNICAL COMMITTEE OF THE MOTOR INDUSTRIES.

The third meeting of the Technical Committee of the Motor Industries was held at the offices of the Institution of Automobile Engineers on Tuesday, June 19. Mr. A. A. Remington (Wolseley Motors, Limited) was elected chairman of the committee for the year, Lieut.-Col. R. K. Bagnall-Wild being elected vice-chairman.

Among other matters upon which a definite conclusion was reached was the adoption of the suggestion of Mr. W. H. Paull that the time is now ripe for a serious effort to be made to introduce an international standard of wheel and tire rims for solid rubber tires. It is suggested that France, the United States, Italy, and Russia would be willing to co-operate with Great Britain in this direction. This view has been forwarded to the Engineering Standards Committee.

Steps are being taken to collect data on several subjects of proposed research, and in this connection an important proposal has been made to the committee that a Bureau of Technology should be established where all technical information with regard to various branches of the motor industry may be obtained, and from which would be issued a periodic precis of up-to-date information relating to the latest advances of science and the possibilities of their application in the realm of automobilism. Such a scheme might be of immense service to the engineers of the automobile industry, but it cannot go through without the financial support of the firms, although it is quite likely that the Government would, through the Department of Industrial Research, make a substantial contribution to income. As yet, the subject has not received any detailed consideration, but it is one on which those interested are invited to express their views.

Another matter of great importance that has been brought before the committee is the proposal to form a central organisation for the better co-ordination of engineering training, and in this matter the committee is already giving all the support that has been asked of it at the present juncture.

The committee is now represented on all the Engineering Standards Committee Automobile Sub-Committees, and steps have been taken to render every assistance in this direction. Steps have also been taken to ensure the proper representation of motor industries on the Civil Aerial Transport Committee, as there is no doubt that mechanical transport must play a very important part in any such scheme.

## MOTOR TRAFFIC NOTES.

The Willys-Overland Car.—Mr. C. L. Van Bever, the energetic Canadian, who started the Goodyear tire business in this country, has acquired a controlling interest in the Willys-Overland motor car business in this country, and will take an active interest in its conduct in the capacity of managing director.

Motor Drivers' Wages Award.—Sir George Askwith's award respecting the wages of drivers of commercial petrol-driven vehicles and drivers of steam wagons was issued on June 29. It gives, for a six days' week, a minimum of 30s. for cars up to 25 cwt., rising to 50s. for cars over two tons. Overtime is to be paid at the rate of 6d. to 9d. per hour, according to the weight of the car. On Sundays and holidays double wages are to be given, and after a journey of more than 14 hours there must be a nine hours' rest.

State Ownership and Control.—Sir Maurice Fitzmaurice, chairman of the Canal Control Commission, on June 27 received a deputation from the Dock, River, and Wharfeside Workers' Union, who submitted proposals for State ownership and control of inland waterways, with management through a representative Advisory Committee. It was stated that there was a strong feeling permeating labour that all modes of transit, including railways, docks, navigable rivers, and canals, should be under the direct control of the State, with co-opted representatives of labour on the management. Sir Maurice promised to lay the views of the deputation before the members of the Commission.

Mr. A. J. Slinn.—A complimentary dinner was given at the Trocadero on June 13 to Mr. A. J. Slinn, the well-known publicity manager of Messrs. D. Napier and Son, Limited, to commemorate his recent wedding with Miss Alice Taylor. Mr. Jeremiah MacVeagh, the witty Irish M.P., presided, with Mr. F. H. Beckham, the chairman of Wills, Limited, in the vice-chair. Some 30 of the intimate friends of Mr. Slinn were present. Mr. MacVeagh made one of his characteristic speeches, diverging for a moment from the occasion to make a touching reference to the tragic death—just then announced—of his old and intimate friend, Major Willie Redmond. Other speakers followed, and gave notable testimony to the popularity of Mr. Slinn, and to the esteem in which he is held by a wide circle of friends and acquaintances.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

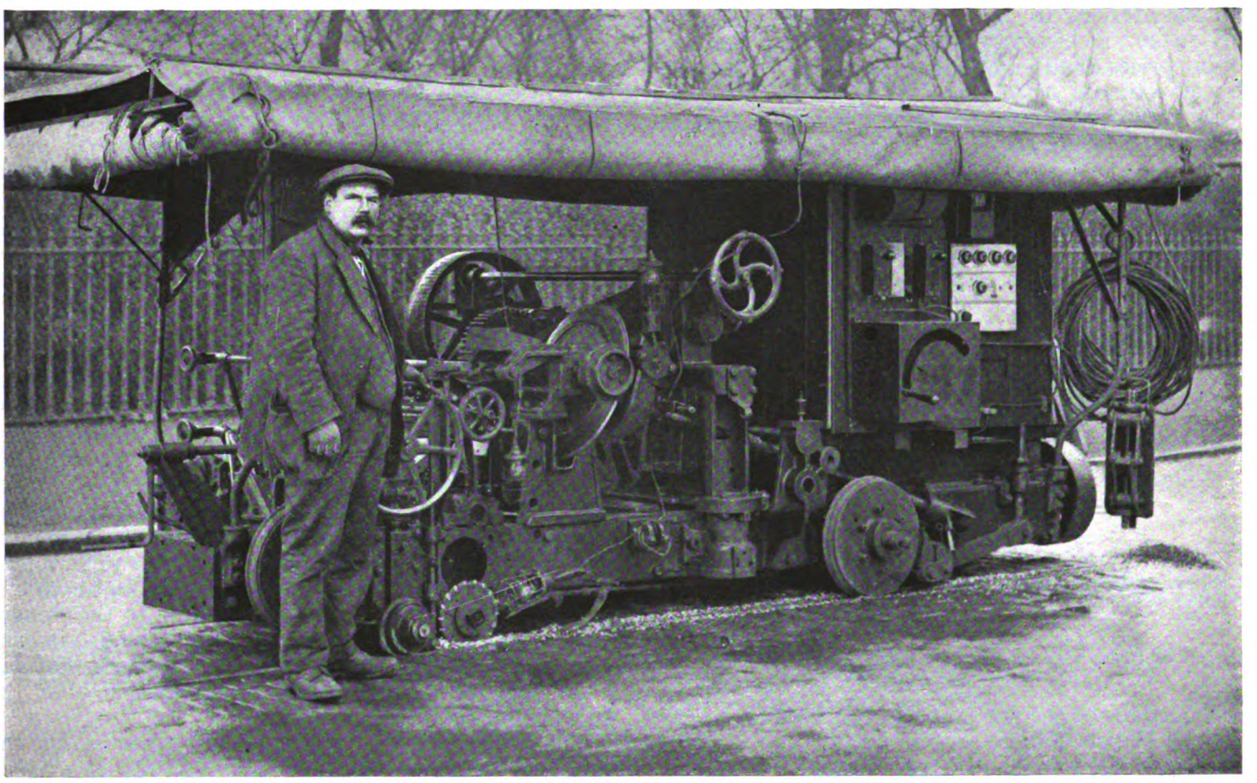
Founded 1892. LONDON, AUGUST 16, 1917. VOL. XLII.

# AN ECONOMICAL MEANS OF RAIL RENEWAL.

LIFE OF RAILS EXTENDED BY REDRESSING THE HEAD.

It is well known that tramways throughout the country are suffering greatly from the inability of the owners, whether municipalities or companies, to maintain and reconstruct the tracks owing to the lack of rails and the shortage of labour. At the end of the war, owing to the great demand that will arise for the necessary materials, rails, cement, granite setts, etc., the prices will no doubt be exorbitant. In the interest of tramway owners, as well as of the public, it would be an immense advantage if some method could be adopted for the purpose of treating the existing rails in such a way as to prolong their life and consequently minimise the demand for steel and other materials. The facts with regard to the tramway situation have been brought to the knowledge of the Ministry of Munitions from time to time. As an indication that they realise the seriousness of the position it is satisfactory to record that they have recently granted an "A" priority certificate to the Woods-Gilbert (British) Rail Grinding and Milling Company, Limited, for the construction of five machines of their latest type; and we understand that one of these machines will be constructed immediately and the others as soon as the necessary materials can be obtained.

This system has been described in previous issues and an illustration of the last machine constructed by the company is appended. We are also able to give sections of rails in Bolton which have been remodelled by the machine. In these drawings the original section of the rail head is shown by the top line, the wear that took place in each case is indicated by the shaded portion, while the part of the groove which has been cut out by the machine to deepen the groove is shown in solid black. The rail section from the Cardiff tramways shows also a portion of the lip cut away.



**Rail-Cutting Machine at Work Deepening Groove of Worn Rail.**

It is perhaps not generally known to what extent rails can be remodelled by the system, but the sections reproduced on the following pages show that rails

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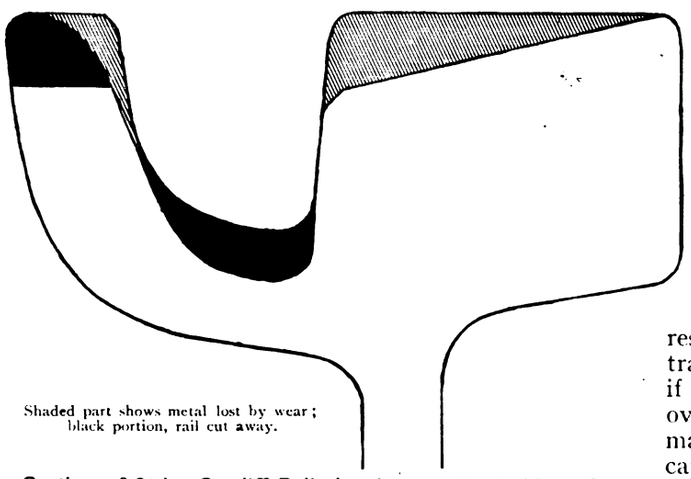
which have become so badly worn as to be useless can be given an additional life of five to eight years. The standard depth of flange on tramway systems is $\frac{15}{32}$ in., and the original depth of groove 1 or $1\frac{1}{8}$ in. Where the tread of the rail in which the groove is 1 in. in depth is worn away $\frac{14}{32}$ in., the flange of the wheel must ride on the groove, and from this time the depreciation of the rail is exceedingly rapid, while the lip of the rail is likely to fracture and break away, thus contravening the regulations of the Board of Trade. The thickness of metal below the groove in some of the rails is $\frac{24}{32}$ in., and with the remodelling machine it is possible to mill out about one-half of this depth, leaving the thickness of metal at the bottom of the groove about $\frac{12}{32}$ in., which is considered sufficient to carry the weight of any vehicular traffic, the guard of the rail being protected by the paving.

Estimates prepared for the reconstruction of the lines of an important undertaking that would normally be required between the years 1915 and 1917, assuming that a supply of rails could be obtained, show that a sum of £35,528 would be required. The estimate under pre-war conditions would have been £21,533. If, however, the whole of the lines were treated by the Woods-Gilbert process, that is, were regrooved and remodelled, the estimated cost would be £2,528, and the life of the rails would be prolonged about four years, by which time, it is reasonable to hope, the cost of rails and other necessary material will have reverted to something approaching pre-war prices. Dealing with the tracks to be reconstructed in the years 1918-19-20, inclusive, the estimated cost based on present prices would amount to £115,300, as against a pre-war estimate of £69,900. If the work were done by the rail cutting process, it is estimated that the cost would not exceed £8,177. The prolonging of the




**Section of 6½-in. Cardiff Rail showing, in Black, Metal Cut Away by Rail Machine.**

life of portions of the track of the undertaking referred to by the Woods-Gilbert process would have the effect of relieving the steel market to the extent of 3,000 tons of rails during that period. As the total length of tramways in the United Kingdom is about 5,329 miles, and assuming that the tracks have an average life of 15 years, the approximate quantity of rails required for the reconstruction would be about 52,935 tons per annum.

No reconstructions have, however, been carried out since the commencement of the war, with the result that a very large mileage will urgently require attention immediately after the war. Each additional year's delay brings other tracks to the time when reconstruction becomes imperative and consequently the demand for steel rails will be well in excess of the supplies in this country and large orders must be placed abroad. Postponement will not be possible at that time, for in view of the industrial demands which must be met after the war it is absolutely essential that tramway undertakings should immediately be put in a position to provide the utmost facilities for working people.

The following table shows the length of single track, the estimated length of track due for reconstruction up to 1921, and the approximate quantity of rails required by 14 tramway authorities in Lancashire.

| Authority. | Total Length of Track (Single Line). | | | Estimated Length of Track due for Reconstruction up to 1921. | | | Approximate Quantity of Rails Required. |
|---|---|---|---|---|---|---|---|
| | M. | Fur. | Ch. | M. | Fur. | Ch. | Tons. |
| Ashton-under-Lyne ... | 9 | 0 | 0 | 5 | 0 | 0 | 400 |
| Birkenhead ... ... | 24 | 0 | 0 | 12 | 0 | 0 | 2,000 |
| Blackpool ... ... | 21 | 5 | 1·10 | 15 | 0 | 0 | 3,074 |
| Bolton ... ... ... | 48 | 0 | 0 | 18 | 0 | 0 | ·,090 |
| Bootle ... ... ... | 8 | 0 | 0 | 8 | 0 | 0 | 1,300 |
| Burnley ... ... ... | 22 | 0 | 17 | 12 | 0 | 0 | 1,920 |
| Darwen ... ... ... | 0 | 6 | 6 | 0 | 6 | 6 | 150 |
| Eccles ... ... ... | 8 | 0 | 5·66 | 4 | 0 | 3 | 330 |
| Manchester ... ... | 180 | 0 | 0 | 22 | 0 | 0 | 3,500 |
| Preston ... ... ... | 17 | 1 | 6 | 7 | 0 | 0 | 800 |
| Rochdale ... ... ... | 28 | 6 | 0 | 6 | 0 | 0 | 1,000 |
| Salford ... ... ... | 56 | 0 | 0 | 31 | 0 | 0 | 5,000 |
| Southport ... ... | 27 | 0 | 0 | 27 | 0 | 0 | 4,455 |
| Stalybridge ... ... | 27 | 4 | 0 | 10 | 0 | 0 | 1,500 |
| Total ... ... | 478 | 0 | 15·76 | 177 | 6 | 9 | 28,519 |
| Tramway systems of the country ... ... | 5,329 | 0 | 0 | 1,984 | 0 | 0 | 317,874 |

As will be seen from the table, out of the total of 478 miles of track, 177 miles will have to be reconstructed up to 1921, for which 28,519 tons of rails will be required. For the whole of the 5,329 miles of tramway track in the country, it is estimated that 1,984 miles will require to be relaid up to 1921, and that to carry out this work 317,874 tons of rails will be required. In addition, of course, there will be the track fittings, including electrical bonding.

An immediate demand for at least 20,000 tons of rails is to be expected at the end of the war, and as we have seen, the cost will be almost prohibitive.

The railway companies will also be in the market for the supply of steel rails, etc., and this will tend to maintain prices for a long time after peace is restored. It will consequently be in the interests of tramway owners and the general industry of the country if the reconstruction of tramway systems can be spread over as long a period as possible. Indeed, in the case of many tramway authorities any addition to the present capitalisation of the undertakings would be disastrous; and it is the more essential that expedients that will avoid the expenditure of fresh capital soon after the war should be found.

The value of the Woods-Gilbert process in the present juncture is very clearly brought out in a report that Mr. E. L. Morgan, borough engineer and surveyor of Bolton, recently presented to the Permanent Way Sub-Committee of Bolton Tramways Committee. As a preliminary he points out that consequent on the war and the difficulties of obtaining material and labour, and on the request of the Treasury that as far as possible all work involving expenditure should be delayed, it had been decided that no track reconstruction work should be carried out in Bolton during 1915. Subsequently it became necessary that the reconstruction proposed for 1916 should also be postponed. Only some short pieces of track have been renewed. On April 4 last Mr. Morgan reported to

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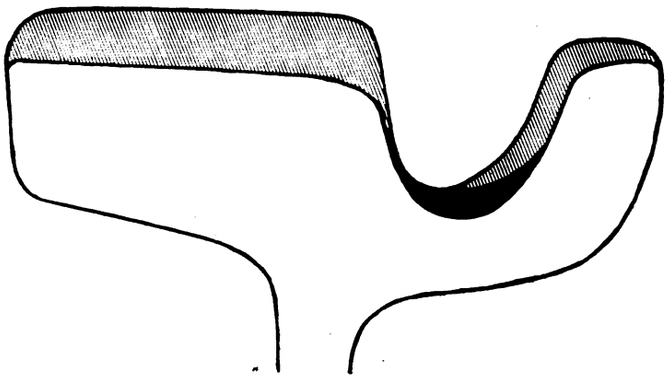
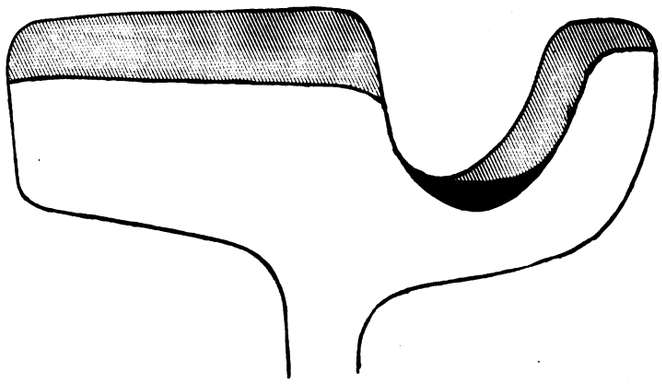
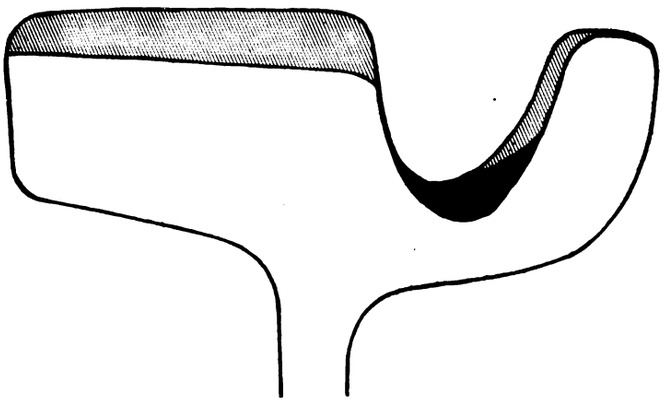


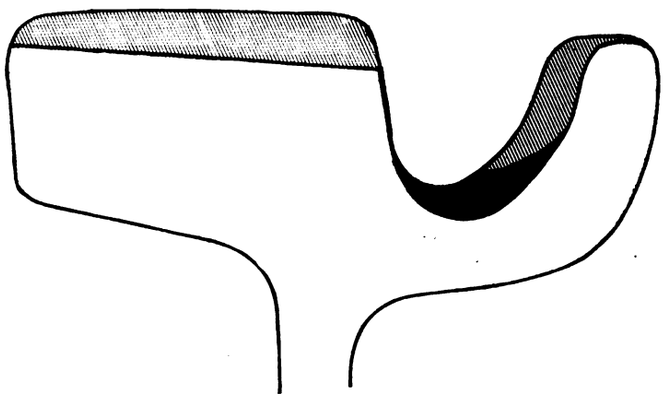
Outward Track, Derby Street (1900).



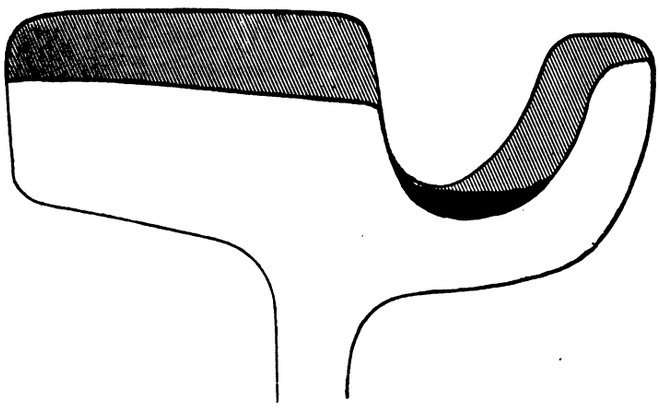
Inward Track, Derby Street (1903).



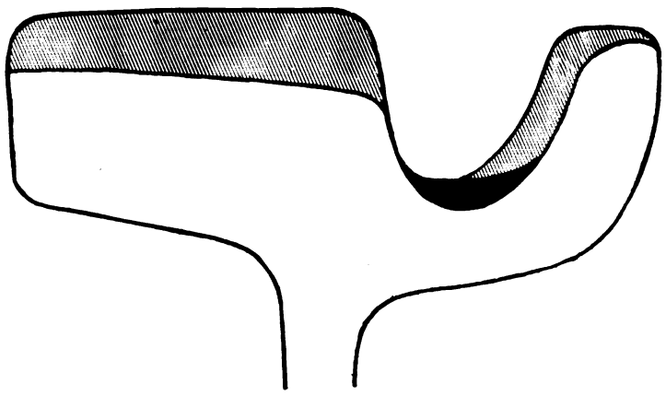
Inward Track, Wigan Road (1900).



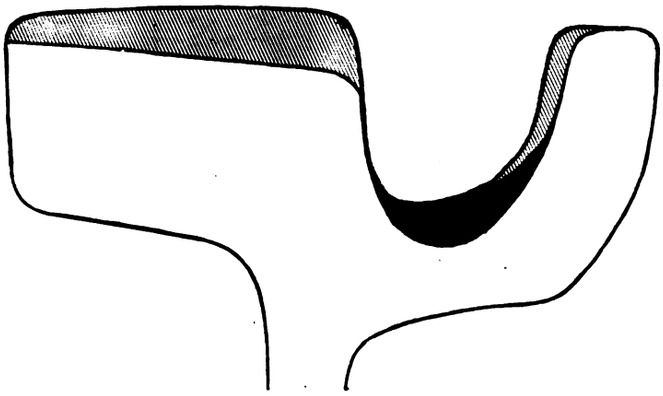
Outward Track, Wigan Road (1900).



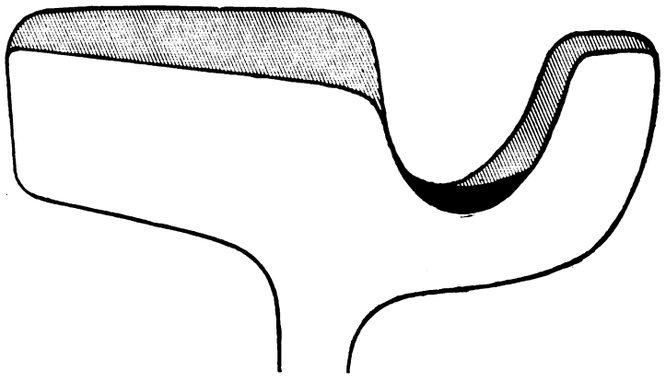
Inward Track, Higher Bridge Street (1901).



Inward Track, Halliwell Road (1901).



Inward Track, Chorley Old Road (1901).



Inward Track, Chorley New Road (1901).

SECTION OF BOLTON RAIL HEADS, SHOWING THE REMODELLING RENDERED NECESSARY BY WEAR.

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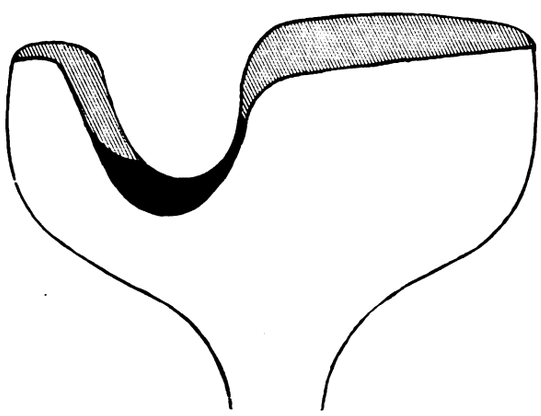
the committee on what had been done by the Woods-Gilbert process in some other towns, and the committee then visited Wigan and Ashton and saw what had been done there. They were satisfied that the process was worthy of consideration. At Wigan an increased life of track of about four years is anticipated, while at Ashton three years' use has already been obtained, and two or three years' more life is anticipated.

On April 10 an inspection was made of the Bolton tracks, and particulars were taken of the depths of grooves, corrugation, etc. From these data Mr. Morgan drew up a statement setting out the work which it was suggested should be undertaken at the present time. This statement showed a length of single rail to be re-grooved of 44,667 yards, a length of single rail from which corrugations had to be removed of 16,710 yards, and 341 joints to be dressed. Most of the rails originally had a groove 1 in. deep, while the present depth of groove varies from 18-32 in. to 20-32 in. Thus in places the grooves are not of sufficient depth to allow of the Bolton standard 18-32 in. wheel flanges. If the cars ride on the flanges on the bottom of the grooves this will cause material damage to the check of the rail, which will eventually fracture. There is increased wear and tear of rolling stock, and broken axles are apt to occur.

Mr. Morgan proceeds to point out the evil effects on the track of rail corrugation, and in regard to



**Wigan Rail, Showing, in Black, Metal Cut Out to Deepen Groove.**

hammered joints he says that in some instances the joints are supported by a short length of inverted rail. It is quite possible that the rigidity of the rail at these joints is responsible to some extent for the hammering and also for some part of the corrugation. It is a significant fact that where Thermit welding has been adopted there are no hammered joints, and the corrugation is less in extent. He is of opinion that when the whole track is Thermit-welded the corrugation will be less, the hammered joints fewer, and the cost of maintenance reduced.

The whole of the work of deepening the groove, taking out corrugation, and dressing up and planing of hammered joints is—Mr. Morgan continues—provided for by the Woods-Gilbert process. The company suggest that the depth of the groove should be increased from 6-32 in. to 8-32 in. This will allow of $\frac{3}{8}$ in. of metal between the bottom of the groove and the underside of the rail below the groove. The tramway authorities at Wigan and Ashton were of opinion that this was sufficient to carry the traffic without any danger of fracture of the check when the paving alongside was in a reasonable condition. To be on a perfectly safe basis, Mr. Morgan puts the estimated additional life on the Bolton system at three years, and this is undoubtedly an ultra-conservative estimate.

The price paid at Wigan for re-grooving the rails is 7d. per lineal foot; taking out corrugation, 6d. per lineal foot; and dressing of joints, 8s. 6d. each. To the latter amount 20s. per joint is added so as to allow for any work required in repacking or lifting the joints, making the total cost per joint 28s. 6d. The Wigan prices are based on the assumption that the work can be carried on for 72 hours per week. In regard to three-fourths of the work in Bolton the hours will not exceed 66 per week, and for the other fourth 36 per week. The Woods-Gilbert Company are prepared to undertake the work on the portion where they are able to work 66 hours at the same rate as Wigan, while for the other portion they would require an increase of 50 per cent.

The length of line to be treated, and the estimated cost, are as follow:—

| | | | | | |
|---|---|---|---|---|---|
| 100,546 lineal feet re-grooving at 7d. | ... | ... | £2,932 | 11 | 10 |
| 33,515 do. do. 10½d. | ... | ... | 1,466 | 5 | 7 |
| 50,130 do. corrugation at 6d. | ... | ... | 1,253 | 5 | 0 |
| 341 hammered joints at 28s. 6d. | ... | ... | 485 | 18 | 6 |
| Total ... ... ... | ... | | £6,138 | 0 | 11 |

As the taking out of corrugation will reduce the cost of maintenance, Mr. Morgan suggests that the cost should be taken out of revenue, leaving a balance of £4,884 15s. 11d. This expenditure will equal £383 per mile. The saving on the depreciation fund by the extended life would in the three years amount to £552 per mile.

Passing from Mr. Morgan's report, it may be noted that it is with the object of enabling the Woods-Gilbert Company to assist the tramway undertakings that the Ministry of Munitions have given them authority to obtain additional machines. The work that has already been done in Bolton, Ashton, Wigan, and Cardiff has been found satisfactory by the engineers in charge of those undertakings, and there is no doubt that the success which has attended the application of the system will be repeated elsewhere.

From information supplied by Mr. A. T. Gooseman, borough engineer of Wigan, it appears that in Wigan about eight miles of rails were remodelled under his supervision. The grooves of the rails were deepened by a quarter of an inch, while corrugations were removed and the joints redressed. He estimates that the work will add at least four years' life to the track, which was worn out. If the rails had not been remodelled it would soon have become necessary to stop the service, as it would not have been safe for the cars to run on the tracks, and new rails could not be obtained.

In our issue of April 12, 1917, particulars were given of the work carried out on the Cardiff tramways with which the late Mr. W. Harpur, city engineer, expressed his complete satisfaction, believing that an additional life of at least five years has been obtained for the track.

The system was, we believe, first applied in this country on the Oldham, Ashton, and Hyde tramways, and Mr. R. B. Holt, permanent way engineer of the Leeds City Tramways, commenting on the work done there, in his book on "Tramway Track Construction and Maintenance," states that after witnessing the operation of the rail planing machine he was favourably impressed with the manner in which it performed the work of deepening the grooves and lowering the check. The work was rapidly executed and with great accuracy. So accurately balanced and adjusted was the machine that it cut the rail groove to within $\frac{1}{64}$th of an inch of the standard depth under all conditions of track.

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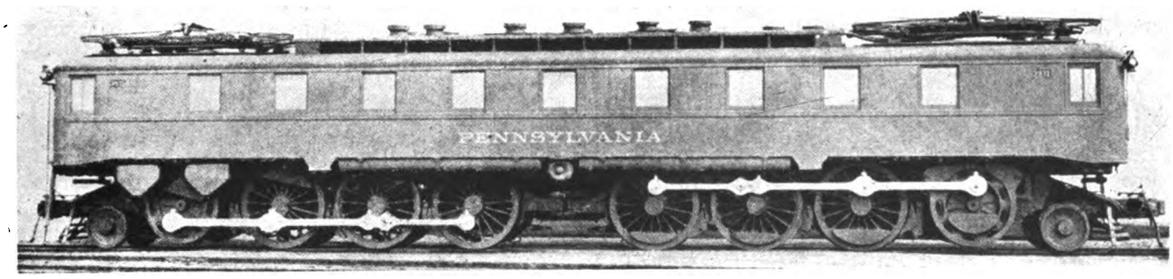
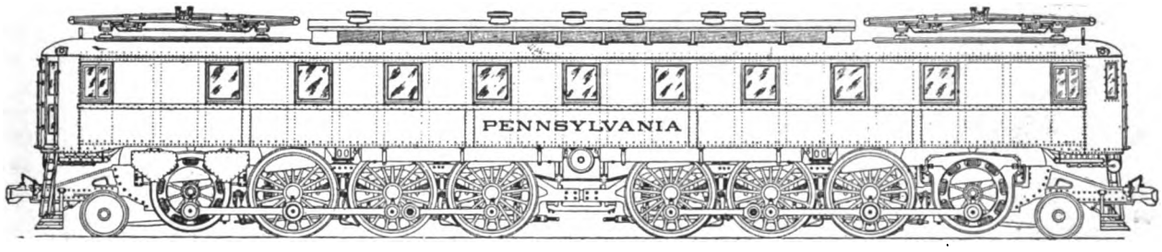
## LATEST TYPE OF PENNSYLVANIA ELECTRIC LOCOMOTIVE.

Within the last few years a number of important railway companies in the United States, when adopting electric traction for certain of their lines, have shown boldness in going in for new types of electric machines to suit the particular conditions of the particular road.



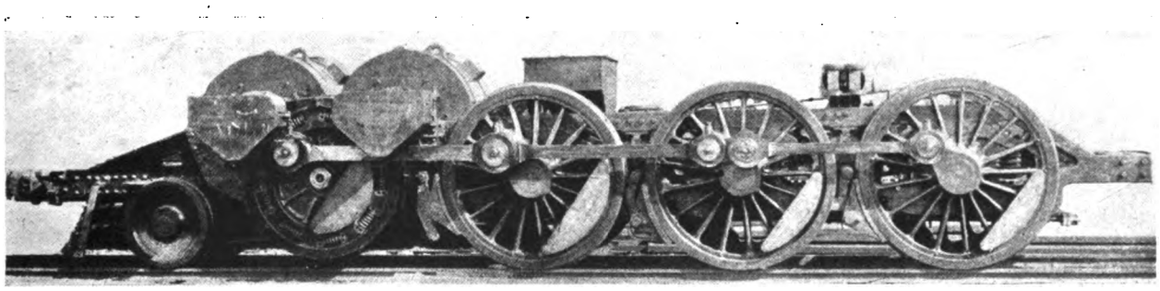

**Latest Type of Pennsylvania Railroad Electric Locomotive.**

Among such companies is the Pennsylvania. It may be remembered that when this company extended its lines from Jersey City by means of tunnels under the Hudson River into the heart of New York City, a bold departure was made in electric locomotives. The motor was mounted well above the driving wheels and connected to them through a countershaft by connecting




**Side Elevation Showing Arrangement of Gears and Driving Wheels.**

rods instead of gearing. This meant that the speed of the motor was the same as the speed of the driving wheels. Direct current was employed, and these locomotives appear to be doing well. In the new machine which is now being tested, particulars of which have appeared in the American railway engineering journals, the arrangements show considerable differ-



**One of the Two Motor Driving Trucks, Showing Position of Motors and Spring Gear.**

ences. This locomotive has to haul very heavy trains over steep gradients. Spur-wheel gearing is reverted to between the motors and a countershaft, from which connecting rods are employed. Three-phase current is used, and an unusual feature is that the locomotive is not in two units but in one, the cab being continuous from end to end.

This locomotive was designed for service in hauling the heavy freight traffic over the Allegheny Mountains between Altoona and Johnstown, Pa., a distance of about 37 miles, including the famous Horse Shoe Curve. The freight traffic over this division averages about 300,000 tons a day. The locomotive will be tested over the Philadelphia-Paoli division, which was electrified about two years ago, and then may be transferred to the Bluefield (West Virginia) division of the Norfolk and Western Railroad for further trial. The latter railway has conditions very similar in many respects to those of the Altoona division, that is, heavy freight traffic and steep gradients. This engine is similar electrically to Baldwin-Westinghouse electric engines used on the Norfolk and Western Railroad, deriving its energy from an 11,000-volt, single phase, 25-cycle system, and changing it by means of a phase converter to three-phase current. Pantagraph collection from an overhead contact wire is employed.

There are four motors, each with a rating of 1,200 H.P., giving the locomotive a rating of 4,800 H.P. Two motors are mounted on each truck frame, and geared to a countershaft from which the driving wheels are driven by connecting rods. The springs in the gears of these countershafts are so adjusted as to give the effect of a solid gear up to a tractive effort equivalent to 25 per cent. of the weight on the drivers, thus producing the effect of a solid gear under ordinary operating conditions. The locomotive is designed for a normal operating speed of 20·6 miles per hour, obtained with the motors in parallel. This speed is the maximum that

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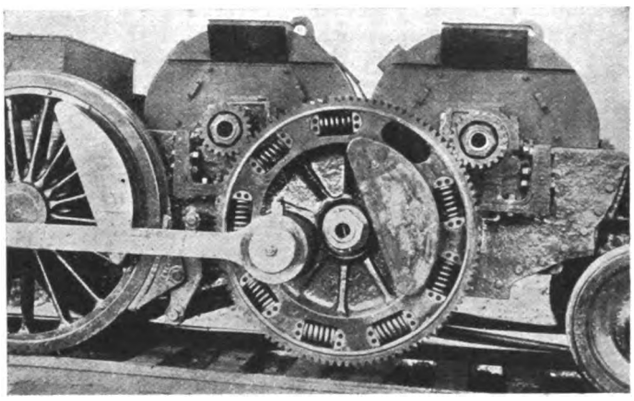
is considered safe for the heavy trains these locomotives will be required to negotiate on the grades of the Altoona division.

Two of these engines, one pushing and one pulling, will haul a 3,900-ton train at this speed up the 12-mile gradient of 2 per cent. from Altoona to Gallitzin, and a 6,300-ton train eastbound up the 1 per cent. grade from Johnstown to Gallitzin, a distance of 25 miles.

A lower speed of 10·5 miles per hour may be obtained by connecting the motors on the same truck in cascade, and this pair parallel with the pair on the other truck. This speed will only be used round the yards and for especially slow movements. Intermediate speeds can be obtained between zero and the maximum by means of a water rheostat control system, which permits a very close regulation of the tractive effort developed by the locomotive during acceleration. The tractive effort developed at the maximum speed is 87,200 lb.

The running gear of the locomotive is similar in general construction and appearance to that used on steam locomotives. There are two trucks each with two motors, the gear wheels being connected by side rods to the driving wheels, of which there are twelve.

The spring gear for each truck is of the three-point suspension type, one point being over the pony truck and the other two over each frame, consisting of equalisers over each box, elliptical springs between



**Details of Spring Gear and Motors with Hollow Shafts.**

journals, and helical springs outside of the first and third journals. The motor and countershaft gears are spiral, and as the gears on each end of the motor and countershaft are cut opposite, a herringbone effect is secured.

Brake shoes are provided for one side of each driver, the brake arrangement being of the usual steam locomotive type with two cylinders, each 16 in. in diameter, placed between the frames between the second and third axles. The train brake and locomotive brake can each be operated independently of the other. Above the frames, and between the first pair of drivers, is a sand-box with sand-pipes leading to the front of the first pair of drivers and to the rear of the third pair of drivers, and equipped with Leach double "E" sanders.

The gear wheels have inward projections forming the countershaft journals. The bearings are solid bronze forced into a circular opening in the frame casting. The centre plate is half way between the first and second axle, at an elevation of about the height of the top of the frames. Between the second and third axles an auxiliary spring support has been applied for the purpose of equalising the loads on the various drivers. The contact between the caps over these springs and the bottom surface of the cab must necessarily be a sliding contact.

Each motor truck includes a pony truck of the Pennsylvania Railroad type, with an elliptic spring on each side of the axle and supported on T-links. As the usual T-links alone will not provide sufficient lateral motion a rocker casting supported by the elliptic springs has been added. The combination T-links and rocker permit sufficient lateral motion for curves of 275-ft. radius.

The articulation between the motor trucks is of a construction similar to a pedestal attached to the cab centre sills. The lower ends of the pedestal legs are connected together with a tie-bar. This permits each truck to rotate round the centre of the centre plate without restriction. All bearing surface in the articulation are plated with manganese steel. The pulling and pushing strains between drawbars carry through the trucks and articulation in a direct plane 34½ in. above the rails, so that the cab is entirely relieved of these strains.

The principal characteristics of this locomotive are as follows :—

| | |
|---|---|
| Railroad classification ... ... | FF1. |
| Overall length ... ... ... | 76 ft. 6¼ in. |
| Total wheel base ... ... ... | 63 ft. 11 in. |
| Driving wheel base ... ... ... | 38 ft. 8 in. |
| Rigid wheel base ... ... ... | 13 ft. 4 in. |
| Height from rail to locked position of pantagraph ... ... ... | 15 ft. 6 in. |
| Height from rail to top of cab ... | 14 ft. 8 in. |
| Width over cab body ... ... | 10 ft. |
| Overall width ... ... ... | 10 ft. 1 in. |
| Diameter of driving wheels ... | 72 in. |
| Weight on drivers ... ... ... | 198 tons. |
| Diameter of pony wheels ... ... | 36 in. |
| Number of driving axles ... ... | 6 |
| Weight on each pony truck ... | 21 tons. |
| Total weight of locomotive ... | 240 tons. |
| Voltage of locomotive ... ... | 11,000 |
| Tractive effort ... ... ... | 87,200 lb. |
| Speed ... ... ... ... ... | 20·6 miles per hour |
| H.P. at 20·6 miles per hour . . | 4,800 |
| Load on 1 per cent. grade ... | 3,350 tons. |

## INCREASING COST OF MATERIALS.

Mr. Henry Mozley, general manager of Burnley Corporation Tramways, in his report for the last financial year, remarks that the cost of materials has gone on increasing and still shows a tendency to rise. He gives the following percentage of increases in the cost of the various materials compared with the prices before the war :—

| | Per cent. | | Per cent. |
|---|---|---|---|
| Tires ... ... ... ... | 235 | Screws, iron ... ... ... | 81 |
| Axles ... ... ... ... | 258 | Gears ... ... ... ... | 64 |
| Bar iron ... ... ... | 89 | Pinions ... ... ... ... | 130 |
| Steel ... ... ... ... | 143 | Gear cases ... ... ... | 46 |
| Axle brasses ... ... ... | 26 | Armature bearing caps ... | 125 |
| Trolley wheels ... ... | 26 | Raw linseed oils ... ... | 64 |
| Armature wire ... ... | 79 | White lead ... ... ... | 111 |
| Commutators ... ... ... | 26 | Zinc white ... ... ... | 119 |
| Malleable iron castings ... | 21 | Spring wire ... ... ... | 60 |
| Controller segments ... ... | 52 | Brake blocks ... ... ... | 20 |
| Controller fingers ... ... | 28 | Cast iron ... ... ... | 22 |
| Lubricating oils, machinery ... | 166 | Deal floor boards ... ... | 154 |
| Lubricating oils, black ... | 71 | Pitch pine ... ... ... | 92 |
| Carbide ... ... ... ... | 77 | Oak life-guard strips ... ... | 60 |
| Glass ... ... ... ... | 23 | Ears ... ... ... ... | 21 |
| Bolts ... ... ... ... | 126 | Frogs ... ... ... ... | 45 |
| Brushes Kitool ... ... | 54 | Guard wire ... ... ... | 191 |
| Coke ... ... ... ... | 57 | Tickets, ordinary ... ... | 125 |
| Sand ... ... ... ... | 36 | Tickets, workmen's ... ... | 57 |
| Cotter pins ... ... ... | 125 | Copper bonds ... ... ... | 100 |
| Wire nails ... ... ... | 394 | Files ... ... ... ... | 60 |
| Screws, brass ... ... ... | 105 | | |

**Lancashire and Yorkshire Railway Electrification.**—The work of converting the Bury-Holcombe Brook line of the Lancashire and Yorkshire Railway has been commenced. The system of electric traction will be the same as that in use on the Manchester-Bury section, which was fully described in THE TRAMWAY AND RAILWAY WORLD of January 13, 1916.

**Railway Electrification after the War.**—In his address at the annual meeting of the General Electric Company on July 17 the chairman (Mr. H. Hirst) remarked that many industries on which the country relied would have to modernise their methods and rejuvenate themselves. Electric power, heat, and light were primary essentials in such a programme ; the depletion of rolling stock in the country would have to be made good, and many of the railway companies would have to prepare for electrification on a large scale.

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# THE FIXING OF TRAMWAY FARES.

By A Special Correspondent.

The previous note published in the issue dated March 15 of The Tramway and Railway World, under the title "Halfpenny Fares on Tramways," was not in any sense a forecasting of a complete policy of fares, but rather an attempt to show first, that on the basis of ascertained facts as to the cost and efficiency of operation there was a want of relation between the rates of fare charged and the expenses incurred in operation, and, second, that the remedy was not merely in the suspension of halfpenny fares as such. In view of certain criticisms which this note has provoked, it is necessary to amplify it in two particulars, still using the situation on the L.C.C. tramways for illustration.

The working expenses of a tramway system may be analysed into two groups—those which are fixed in relation to the car mileage worked, and those which vary with the car mileage. Taking the detailed expenses of the L.C.C. tramways for the year 1915-16, there are six main divisions, viz., power, traffic, advertisement, repairs, general, and special. Of these power, traffic, and repairs would seem to have direct relation to the work performed or the car mileage run, and advertisement, general, and special might be taken to be fixed irrespective of the work performed. This is a rather rough analysis, as there are portions of the expenses under each division about which there might be argument on their correct allocation, and it may be admitted at once that the balance of advantage is with the fixed expenses. If, however, 10 per cent. of the variable expenses be transferred to the fixed, as representing the initial establishment, and ignoring the possible existence of ample and expensive operating margins, the result will be approximately accurate, and shows as follows :—

| | £ | Proportion. | Pence per Car-mile. |
|---|---|---|---|
| Fixed expenses ... | 493,895 | 30 | 2·53 |
| Variable expenses | 1,199,765 | 70 | 5·91 |
| | 1,693,660 | 100 | 8·44 |

As the fixed expenses have no immediate relationship to the service rendered, it must follow that every passenger must pay an equal proportion of them. Otherwise, as the variable expenses have a direct relationship to the service rendered, that is the mileage covered, every passenger must pay a rateable proportion of them in accordance with the length of journey taken.

Turning from working expenses to reserves for renewals, the cost of renewals would clearly follow the volume of service rendered and would be proportionate to work done.

With net earnings the correct allocation is much more difficult. It follows no simple rule. It is at this point that the maxim which commends charging what the traffic will bear comes into play, with of course a reasonable limitation of net earnings. Clearly, any traffic which would yield any margin of profit is acceptable so long as it does not hinder the carrying of other traffic which would yield a higher margin. If the net earnings were to be distributed equally over all passengers carried, halfpenny fares become impossible, for the burden to be met by the halfpenny fare is greater than the halfpenny. The question then resolves itself into whether halfpenny passengers can be made to pay a penny, and if not, whether the cars are so overcrowded at most points on a route that the abolition of halfpenny fares is warranted by the existence of more remunerative traffic. (It was shown in the preceding article that under certain conditions halfpenny fares were more remunerative than penny fares where the penny distance is prolonged.) This same line of argument will disqualify all cheap or reduced fares, such as those for workmen and excursions. It may therefore be said to disqualify itself.

The correct solution involves a consideration of the policy underlying the development and operation of the transport system. If the policy is purely grounded in financial considerations, then the halfpenny fare may not be justified, but if the policy is grounded in an attempt to meet the public convenience and requirement in the largest measure, then the halfpenny fare is sound. And so for workmen and excursions. The correct solution also involves a consideration of the response which the public will make to a finely graduated scheme of fares as against a more abrupt one. This consideration comes in to reinforce that derived from the public convenience and requirement, for the better adjusted the fares, the greater the volume of traffic, and in this is the justification of the halfpenny fare in normal times and on normal sections of route. Still there can be no sure rule for the distribution of the net earnings, but reliance must be placed upon the judgment of the management. Here is the place for competent management and advice.

As the largest portion of the L.C.C. tramways traffic is carried at penny fares, and as the average receipt from all traffic is just a penny, for the purpose of the original argument as to the correct penny distance it may be convenient with this warning to treat the net earnings as falling entirely into fixed charges to be levied equally on all passengers. This may be the most unfavourable hypothesis. The final result is shown in the following table :—

*Fixed Charges to be levied per Passenger.*

| | Pence per Car-mile. |
|---|---|
| Fixed expenses ... ... ... ... | 2·53 |
| Net earnings ... ... ... ... ... | 3·29 |
| Deficiency in net earnings ... ... ... | ·41 |
| Total ... ... ... ... ... | 6·23 |

*Variable Charges to be levied per Passenger-mile.*

| | |
|---|---|
| Variable expenses ... ... ... ... | 5·91 |
| Renewals ... ... ... ... ... | 1·00 |
| Total ... ... ... ... ... | 6·91 |
| Grand total ... ... ... ... | 13·14 |

(Something of this sort would seem to be the purport of the analysis made by the Ilford Tramways manager.)

When it is a matter of applying passengers and passenger-miles to the figures, an element of guesswork must come in. The average length of the journey taken is not known. In calculating the average load of 23 passengers per mile, it was assumed that every passenger took a full ride. It therefore represents, as previously stated, "the highest possible reckoning." It is most likely, as a critic points out, that the average load did not exceed 16 or 17, but it must be clearly recognised that the lower the figure accepted, the more acute is the problem of the penny distance, as the greater is the cost per passenger.

With a view to illustrating this point fully, it may be as well to apply a series of figures to the fixed and variable charges per car-mile already ascertained. The number of passengers booked per car-mile run may be taken as 11 or 12, and the average load per car-mile run may be taken as anything from 16 to 23,

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varying with the average length of journey taken per passenger.

The following table gives the results :—

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Passengers booked per car-mile ... ... ... ... | Actual 11·39 | 11 | | | | 12 | | | |
| Average journey taken, estimated miles ... ... | — | 1·45 | 1·55 | 1·64 | 1·50* 1·58* 1·73 | 1·67 | 1·75 | 1·83 | 1·92 |
| Passengers carried per car-mile or average load ... | — | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| | d. | d. | d. | d. | d. | d. | d. | d. | d. |
| Fixed charges to be levied per passenger booked ... | Actual 6·23 | ·57 | ·57 | ·57 | ·57 | ·52 | ·52 | ·52 | ·52 |
| Variable charges to be levied per passenger booked per car-mile ... ... ... ... | 6·91 | ·43 | ·41 | ·38 | ·36 | ·35 | ·33 | ·31 | ·30 |
| | 13·14 | | | | | | | | |
| Proportion of total charges attributable to carrying a passenger one mile ... | | 1·00 | ·98 | ·95 | ·93 | ·87 | ·85 | ·83 | ·82 |
| Miles which passenger could be carried profitably for one penny ... ... | | 1·00 | 1·05 | 1·13 | 1·19 | 1·37 | 1·45 | 1·55 | 1·60 |
| Distance which could be allowed for a penny fare, assuming each passenger travelled on the average 75 per cent. of the full distance ... | | 1·33 | 1·40 | 1·51 | 1·59 | 1·83 | 1·93 | 2·07 | 2·13 |

* Based on 12.

The disparity between the row of figures showing the estimated journey taken and the row of figures showing the miles which a passenger could profitably be carried for a penny indicates the disparity which exists between the scheme of fares and the cost of service, when the average fare by good luck is also a penny. The argument of the first note still stands, that the general level of fares on the L.C.C. system needs to be raised for safety, particularly when the exceptional factors now assisting their operation are removed.

Looking at the table last given, there is a further comment to be made. It may be said that the table shows that given a good load factor, two miles can be afforded for a penny. Before jumping to this conclusion, it is as well to compare the average journey taken with the distance allowed for a penny fare, when it will be seen at once that the assumption that a passenger only travels 75 per cent. of the distance offered is falsified right at the start. With an average load of 22 to 12 passengers booked per car-mile, the average journey taken is 88 per cent. of the full distance allowed. If the passengers booked were increased to 13, it would still be 81 per cent., and at 14 would be 76, which illustrates the extent to which the operating efficiency must be improved. Actually the case is even worse for the longer the distance offered for a penny, the less the proportion of the full distance which will be travelled on the average. That is to say, the statistics and the assumption have moved in opposite directions, and the breach to be filled is really wider.

These rather detached notes only carry the argument a little nearer to the end. Someone with more time and less cares should work the whole position out to a conclusion. The writer would apologise for this rather tentative effort.

**Results of Fare Revision at Walthamstow.**—Mr. Wm. Murray, manager of Walthamstow Tramways, in his annual report for the year ended March 31 last, says that since the construction of the tramways the Council has sought to give the cheapest possible travelling facilities and at the same time to make the department self-supporting. They succeeded in the latter ambition in 1910, 1911, and 1912, when the advent of motor omnibus competition gave them a set-back, and it became evident during the succeeding years that some change must be made if the department was to pay its way. It was finally decided to abolish halfpenny fares for adult passengers, to discontinue issuing cheap return tickets, and to increase the price of workmen's tickets by 50 per cent. The change has been amply justified by its results. The traffic revenue for the year increased by £9,518, and the net balance was £6,800, as against £816 during the previous twelve months.

## THE SPIRIT OF THE TIMES.

By Capt. P. H. di Marco, R.E., A.I.E.E.

Frankness is a charming quality. This article is frank—very frank. The reader may complete the syllogism as it pleases him. The writer has been out of live practice since the autumn of 1914. Most of his time since then has been spent in France, but what spare time came his way on those rare occasions when he was behind the line was expended, from an interested observer's point of view, in as exhaustive a study as possible of the various tramway systems of the localities in which he happened to be.

There is little new in this article—a few odd points perhaps rather forcibly emphasised, a strong conclusion—some will probably say a wrong conclusion, and no statistics. Perish the thought! The writer is much too modest to claim any intimacy with the word. No! Statistics *per se*, and within the meaning of the Act, so to speak, will never dim the lustre of this effort. The only claim for this article is that it very inadequately expresses the few reflections of one who once imagined he could distinguish the difference between the two ends of a tramcar. And now to our "muttons."

### Co-ordination.

At one place many of you know is a small concern running about eight kilometres of tramways with the overhead system, but instead of the wheel trolley method of collection the bow method is used. That is all. That is the only point worth noting. After careful study, under many trying conditions, the writer is convinced that it is the safest from a public point of view, and the most economical. If tramways were all bow-equipped to-day how much in running expenses would be saved, what wear and tear would be prevented, and what consequent economy would be secured!

At another place the longitudinal wood sleeper is freely used as a margin on each side of the rails, and setts in between. Many of these sleepers must have been down for years, in the busiest parts and on all sorts of gradients, and the life of them seems almost eternal. If English practice included the substitution of wooden sleepers for granite setts or macadam, how much in permanent way repairs would be saved?

In many of the towns the streets are very crowded, very hot, and very narrow. Some are so narrow that two vehicles have scarcely room to pass. The pathways also are narrow. Six people in a group would almost block up the street. Tramway lines run along the side of such streets, and each car has one, and sometimes two, trailers running under the heavy conditions of rush, fetes, and market traffic, and never an accident, hold-up or any inconvenience to anybody or anything to speak of.

If tramway authorities to-day could obtain powers freely to use trailers, how much economy would be effected, and how much would the revenue be increased. Why not trailers as a general practice? And if not, why not?

In French tramcar building provision is made for carrying passengers on the open platform at each end. In one town fifteen was the maximum number allowed on each platform. Trailers also were used, and women drivers, women conductors, women point setters, and probably many other women employees. Away the cars went, up the steep gradients and narrow streets to the heights above—and everybody was happy.

The heavy Juggernaut double-deck cars of Britain are not out of date—by no means; but if they had been strangled in their birth it is probable that, apart

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from the great reduction in general expenses which would have ensued, many labour questions and their inconveniences would have been avoided.

Authorities, municipal and otherwise, have doubtless considered the advantages of the various types of car now in existence in the kingdom, but there is no British standard, and in that respect we still muddle along. Like the walrus and the carpenter who "wept like anything to see such quantities of sand," it makes one weep like nothing on earth to see such quantities and varieties of cars. If they "were only swept away it would be grand," and replaced by a standard. What an ideal!—bodies, trucks, spare parts, fares, mileage, and even systems—all standardised. Conditions of labour, profit and loss, rates of pay—all standardised. Employers and employees all sharing directly in the prosperity as well as the hazardous risks of their undertaking. All the municipalities and private concerns standardising, and federating, and pooling the net financial result.

This sounds like a tramway Utopia. In short, it sounds a mad ideal; but is it? Think it over. Then think it over again, and consider the mountains of difficulties between capital and labour, parliamentary and local authority procedure, finance, and administration, books and forms, and a thousand superfluous and extravagant things—all gone, no longer to disturb the peace of, or increase the anxieties of, those engaged in traffic affairs.

Is it a dream? Is it not rather the very trend of present day industrial development? The dawn of the new spirit of new after-war conditions. He who runs may read, for the moral is obvious.

A tramways minister! As the Psalmist said, "Let him arise, and let his enemies be scattered." It is worth a thought.

### Co-operation.

It is assumed that everyone engaged in the tramway industry will understand what is meant by the Union. To the writer it means "The Tramway and Vehicle Workers' Union." Please do not blush or turn pale. There is no necessity for anything but a few dispassionate moments. The writer loves the rolling sound of the title of this tramway organisation as well as he loves the restraint, generally speaking—mark you, generally speaking—with which its objectives have been invariably attained.

A union should be one of the finest blessings ever conferred upon an industry. You are not expected to swallow this statement right off, but you will in time, so soon as its enormous importance dawns upon your professional horizon; meanwhile it is offered "free, gratis, and for nothing." It simply reiterates a fact which, however well understood by employees, has not always been sufficiently intelligently absorbed by all employers.

The real and true spirit of a union is usually well and carefully planted by its officials and members on the one side, but the cultivation, nurture, and recognition so necessary for its successful existence have been equally well and as carefully neglected, or at best simply tolerated, by some of "those who shouldn't," on the other side. The fruit therefore can never fail to be sour and disappointing, yielding at best a bad "pip" to each side.

Now this should not be. One hesitates to describe it as "mutual distrust." What it really is, however, is mutual ignorance, which is a much less malignant disease than mutual distrust.

Some people will not like this plain speaking, but, like a great many other things in this changing kaleidoscope of industrial life, like it or not it is in our best interests to have to know it.

Probably it will be imagined that the writer holds a brief for trade unionism. Nothing of the kind. He knows nothing about the union referred to above; he does not even know the location of its headquarters, and has never read any publication emanating from it, but he has seen, he has heard, and this article represents his conclusions from the straight, practical point of view.

Two great tonics are required to ensure the success of a great industry, viz., a union and mutual confidence.

Now, how best can mutual confidence be achieved? By the diligent study of the broad principles of trade unionism, the huge obligations of capital and labour and the enormous mutual advantages of sharing the profit or loss.

The writer suggests that all tramway managers should well acquaint themselves with the details and objects of the different unions which come to their professional notice, identify themselves as fully as possible with their aims, and cultivate invariably a sympathetic attitude when dealing with trade union matters with employees, because in this way not only is a manager likely to obtain the esteem and best efforts of the employees, but he is more qualified correctly to advise his committee or board whenever such questions come up for consideration. Further, it is suggested that committees and boards should encourage this social study on the part of their principal officials.

And now a word for the employees. It is not every employee who is a member of a union. He should be, however, where unions exist, because, apart from his own interests, his aloofness from the trade organisation is very frequently the source of grave trouble, friction, and anxiety to all concerned. There is nothing to gain in being "odd man out" if the unanimous feeling is that you should be in. It is not fair to the employers. The mutual confidence previously referred to begins with the first step taken to become a member. Having done so, the employee should not imagine that he is now free to adopt a generally lax attitude, or is to content himself with doing the barest minimum of work possible, because that sort of thing is not playing the game.

His responsibilities and obligations have only just begun. He is responsible to his union, to his fellow workers, to his employers, and, most important of all, to himself, that he does not let them down, thus losing his own self-respect. Gently, yet firmly, treated, he will not make mountains out of molehills; he will take the rough with the smooth, and do his level best to understand and conscientiously perform the duties allotted, so that, sooner or later, promotion and advancement may come, with the result that capital and labour are both proud of their sons of industry.

All this may sound very like twaddle, but the tremendous point the writer wishes to emphasise is that the trade unions have become an integral and vital part of modern industry. They have arrived, and too few attempts are made generously and broadmindedly to recognise their efforts in the direction of consolidating man power and their ability to do so.

There is not only dignity of labour but dignity of capital, and the controlling powers of these industrial forces should be harmoniously animated with the dignity of mutual responsibility and all that it implies, and if they can work together as a joint committee so much the better.

**Railway Restrictions.**—Intimation has been given that the public must be prepared for a further reduction of railway facilities in October, for the exigencies of the military situation have compelled the railway authorities to consider the further restriction of services.



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THE
# Tramway AND Railway World

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## LONDON, AUGUST 16, 1917.

**The Transfer Problem in London.**

Mainly because of fraudulent use, and of difficulties in checking, transfers are not popular among tramway managers. The original reasons that led to their issue were the convenience of passengers and a desire to avert the payment of an unduly increased proportionate fare entailed by two separate tickets having to be taken. Increased costs of working owing to the war, combined with a desire to lessen the work of depleted staffs, have led to the placing of restrictions on the issue in some towns and to the abolition of transfers in others. In connection with the prolonged consideration given to fares on the London County Council's tramways, some alterations have been effected in the regulations for the issue of transfers. While in the main the changes are to be commended, considerable care will need to be exercised to avoid their resulting in an adverse effect on the revenue. The reason is the existence of competition; and it was to assist in averting the effects of this competition that the Highways Committee have during the past few years sanctioned extensions of the use of transfers. Until the institution of the restrictions upon the importation of paper, the department had so well advertised the transfer facilities that their conveniences are firmly fixed in the public mind to the benefit of the traffic receipts. "Don't wait! Take the first car!" had become the best known slogan in the Metropolis, and passengers who availed themselves of the invitation had a further favourable impression made upon their minds by the extensively advertised facility for changing cars at any one traffic junction convenient to themselves. Added to these advantages was the facility thereby given for using more than one route to a destination, according to the passenger's convenience. Unfortunately on some routes, mainly used by munition workers, a practice had been allowed by conductors to arise during the war of permitting a change of car to be made at two points instead of only one. This innovation opened a door to great abuse if a passenger were so inclined, as the tickets are not printed to permit of more than one punch mark before cancellation. While it would not be impossible to frame a ticket that could be so dealt with by the conductor, the present time is not opportune for the innovation. Naturally, therefore, the practice has been forbidden. A change with a still wider effect is the abolition of the facility hereto given to holders of workmen's tickets to make a return journey via a route other than the one by which they travelled in the morning. This advantage was also conceded in the case of the ordinary return ticket; but as the latter has now been suspended it would have pampered the already too favoured workpeople to permit the continuance of the privilege to them. Consequently the Council have decreed that the return journey must be made on the same section as that on which the ticket was issued. While the new regulation will enable better oversight of workmen's tickets to be maintained, it may possibly be found to lead to congestion. Obviously "workmen" are got away from the busy loading points on the Victoria Embankment more expeditiously if they are allowed a choice of routes. Two new restrictions that will need to be carefully watched are those by which transfers are to be issued only where there are no direct services, and that the tickets will be available for change of cars at specified points only. The first of these regulations

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renders futile the exhortation to "take the first car," as passengers have done, changing on a transfer at a point through which more than one section of line is merged on the way to the Embankment. As to the second new rule, there are routes upon which many passengers change cars at a quieter and safer spot than that which is declared to be the place for changing. It remains to be seen whether the public will consent to be forced to journey by specified routes instead of being allowed to travel with a transfer. Many may elect to use another class of vehicle that stands invitingly by the side of the pavement.

**Industrial Research.** The British Department of Scientific and Industrial Research have published the first of a series of papers bearing on industrial research. This first number relates to the United States of America. Much help should be obtained in the task of readjusting the sense of scale in this country in dealing with the problems of industry by a realisation of the progress made in the United States. The present report, of which the compiler is Mr. A. P. M. Flemings, was prepared for publication by the courtesy of the directors of the British Westinghouse Electric and Manufacturing Company, of Pittsburg. Well illustrated descriptions are given of laboratories in America, and we have a discussion of legislative and other influences tending towards the nationalisation of research. Then comes a consideration of the increasing necessity for research in this country and suggestions for the development of such work. Mr. Fleming draws a number of conclusions. For example, he says that the full benefits of scientific investigation will not be obtained unless the results are applied by suitably trained men. The development of research on a large scale will tend to attract to the ranks of industry many of the ablest young men, who nowadays enter non-productive professions. In view of the expenditure involved, great need exists for bringing continually before the public the necessity of industrial research, with its possibilities and benefits. A new phase in industrial and economic life is commencing, and its development will be governed very largely by the extent to which new scientific knowledge is obtained and turned to the benefit of mankind. There is a mass of interesting and useful material in the book, and no doubt there will be differences of opinion on some of the points. Every manufacturer and educationist should study the work, for the process of awaking this country to the need for such research carried on systematically on a large scale is by no means complete. Even if it were, the work for the most part still lies before us of providing the machinery. We may take it for certain that after the war the elaborate organisation of the Germans in this direction will become still more elaborate, with the object of making up what they have lost. This country must not be behind in the race.

**Employers and Employed.** There is much wisdom and there are useful proposals in the interim report issued in July of the Sub-Committee (or Reconstruction Committee) on Relations between Employers and Employed. An initial difficulty in carrying out the proposals lies in the fact that there is so much of instability and uncertainty in connection with the acceptance and carrying out of any general scheme by the working classes. Even when the adherence of the heads of the trade unions is obtained, the doubt remains and is often justified as to whether the many-headed rank and file will agree and whether, if they do agree, they will steadfastly adhere to the bargain. Subject to these considerations, the proposals of the Sub-Committee appear to be promising. Appointed with Mr. J. H. Whitley, M.P., as chairman, who, as shown in his office of Deputy Speaker and Chairman of Committees of the House of Commons, possesses both firmness and tact, the Sub-Committee's business was to make and consider suggestions for securing a permanent improvement in the relations between employers, and workmen and to recommend means for securing that industrial conditions affecting the relations between employers and workmen shall be systematically reviewed by those concerned. In this interim report the Sub-Committee have confined themselves to the problem of establishing permanently improved relations between employers and employed in the main industries in which there exist representative organisations

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on both sides. The war has enforced a reconstruction and has also made the time opportune. The co-operation of all classes must be continued after the war, and the financial condition of manual workers must be improved. Industrial conditions will need careful handling if grave difficulties are to be avoided; for the workers will be found far less tractable than hitherto. These things being so, the Sub-Committee recommend that the Government should propose to associations of employers and employed the formation of Joint Standing Industrial Councils in the several industries. These Councils should particularly direct themselves to the establishment of a closer co-operation between employers and employed. For the establishment of the new regime it will be necessary by mutual consent to set aside the guarantees given by the Government to restore trade union rules suspended during the war. Local and works organisations are also proposed. For the numerous subjects to be considered by all these new bodies, reference must be made to the report itself. Here it can only be pointed out that the work proposed is a gigantic one. It not only involves the setting aside of many baneful trade union ideas, but the creation of new industrial ideas under which the workman would not only have more influence upon industrial management and greater security and remuneration, but would have to become a co-operator in the development of his industry with his heart in the work. Not merely wages, but technical education, industrial research, facilities for utilisation of inventions, and many other things would come within the purview of the bodies to be established. In fact, if everything foreshadowed in this report could be brought about, we should have a new industrial world. All concerned must try to make such a scheme a success. The newly-formed Industrial League, to which reference is made elsewhere in this issue, is in full agreement with the proposals of the committee; and those who are anxious to aid in the encouragement of harmonious relations between employer and employed will discover practical ways of assisting the movement by investigating the objects and methods of the new association.

## LONDON SAFETY COUNCIL.

Although the London Safety First Council only came into existence during the latter half of last year a large amount of exceedingly useful work has been accomplished in the education of drivers and the public. A number of committees of the Council have formulated various spheres of activity in the campaign, which is an enlargement of the work that the London General Omnibus Company carried on for several years. Below particulars are given of developments adopted at the July meeting of the Council, notably a competition in freedom from accidents for drivers of all classes of vehicles. An effort is also to be made to institute a campaign in the elementary schools.

Another branch of the work is the issue of posters and leaflets. Poster No. 1 and Leaflet No. 1, entitled "Hints to Drivers," which contain the rules of the road, hand signals, etc., have proved to be very helpful in reducing accidents. Poster No. 2, which was issued last month, is entitled "Dont's for Drivers of All Classes of Vehicles." It is illustrated by the photographs reproduced on page 107. The introductory paragraph mentions that since the war began over 2,000 persons, of whom 700 were children under 15 years of age, have been killed in the streets of the metropolitan area. It is believed, the poster adds, that many of these accidents were avoidable, and an appeal is made to drivers of all vehicles to exercise every care. Then follows a dozen suggestions based among other things on the advice attached to the accompanying illustrations, which depict incidents that may be seen in almost any street.

Copies of the posters and leaflet may be obtained from the Joint Hon. Secretaries, London Safety First Council, 31, Westminster Broadway, S.W.1, who will be glad to receive suggestions for the furtherance of the movement.

## MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL CONFERENCE.

The annual business meeting and conference of the Municipal Tramways Association will be held at Blackpool on Thursday and Friday, September 20 and 21. The last two meetings took place in London, and in view of the fact that a large number of the members come from the north, and owing to the increased railway fares and limited hotel accommodation at the present time, it was felt that a meeting in the north would meet the wishes of the members.

Thursday, the first day, will be devoted to the discussions and the second day to the annual general meeting. Reports upon the following subjects will be presented and discussions will follow:—

"Principles to adopt to ensure the highest net earning capacity," by Messrs. G. W. Holford, general manager of Salford Corporation Tramways, J. Barnard, general manager, Bolton Corporation Tramways, P. Priestley, general manager, Oldham Corporation Tramways.

"Rules of the footpath," by Mr. James Dalrymple, general manager, Glasgow Corporation Tramways.

"Differentiation in tramway fares," by Mr. W. Murray, manager, Walthamstow Council Tramways.

"Development of tramways." (The name of the opener of the discussion has not yet been communicated).

The headquarters of the association will be at the Savoy Hydro, North Shore, Blackpool, where the meetings will be held. Following the arrangements which have met with the approval of the members for the past three years, there will be no public functions.

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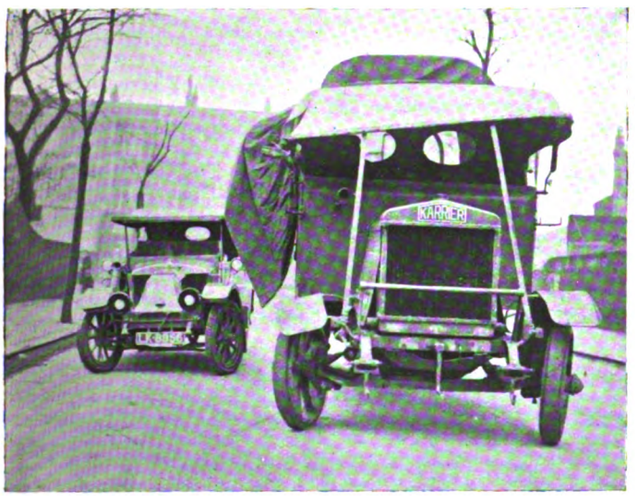
# LONDON SAFETY COUNCIL'S DON'TS FOR DRIVERS.

Don't Doze.

Don't Ignore Cyclists—They are Liable to Side-slip.

Don't Regard Children as Grown-ups.

Don't forget that some Pedestrians are deaf, others short-sighted.




Don't Fail to Tie Down the Tarpaulin.

Don't Leave Your Vehicle Unattended.



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## RECENT LABOUR DIFFICULTIES.

BURNLEY.

Owing to a local dispute between the men's unions a strike of the drivers and conductors on the Burnley Corporation Tramways took place on July 14. The general manager issued a notice pointing out that the strike was contrary to the understanding between the executive committee of the Tramway and Vehicle Workers' Union and representatives of the tramway authorities of Lancashire and Cheshire, and that no complaints or requests had been made to Burnley Corporation. The latter body, however, showed a conciliatory spirit, despite the unjustifiable nature of the strike, but as this proved unavailing, they issued advertisements for new employees. Some negotiations followed, and on July 23 the General Purposes Committee of the Corporation, after a meeting with officials of the two unions concerned, resolved that before negotiations could be entered on with reference to the dispute between the two unions the men must resume work. The result was that the strikers went back to their duties.

EDINBURGH.

An arbitration between Edinburgh Tramways Company and their employees was conducted on July 19 by Sir Richard Lodge, who afterwards issued the following award:—(*a*) Pointsmen, drivers, conductors, and regulators—that a war bonus of 5s. per week be paid to men employed as above, and also to depot staff, pit and pulley greasers. (*b*) That a war bonus of 2s. 6d. per week be paid to conductresses. (*c*) That a war bonus of 1s. 6d. per week be paid to boys under 18 years of age. (*d*) That time and a half rates be paid for Sunday duty between 6 a.m. and 12 midnight to the departments not already in receipt of the same, with the exception of the splicers and to the employees who are not paid on time rates but receiving a weekly wage. (*e*) That the above payments be reckoned from the first pay-day following the issue of this award. (*f*) That while the company pay the war bonus as granted above, the free passes shall be withdrawn, but all employees shall be carried free when going on or off duty or on any journey connected with the fulfilment of their duties to the company.

LEICESTER.

Leicester Town Council held a special meeting to consider a report by a committee recommending that the employees of the Council receiving under £200 a year should be paid a 12s. war bonus, and that women employees should be paid a 10s. war bonus. It was explained that all the bonuses granted since July, 1914, would be calculated as part of the 12s. The Mayor said that the proposal meant the addition of £26,922 to the previous bonuses, which amounted to £39,004. The total was practically equal to a 1s. 3d. rate. Alderman Banton moved an amendment to make the bonus 12s. to both men and women. The Tramways Committee, he said, had arranged that women who took on men's work should receive the same pay as the men. In the course of discussion it was asserted that if the women did not get equal treatment there would be unrest and possibly a strike. After an adjournment to allow the committee to look into the matter, the Mayor said that they could find no document which justified the assertion that there was an agreement that women were to be paid the same wages as men. The minutes of the Tramways Committee showed that the men were to have a 12s. bonus and the women a 10s. bonus. He suggested that the Council should pass the recommendation now before them and then apply to Sir George Askwith for a ruling regarding the women having the same bonus as the men. Alderman Flint stated that at first the women, although paid the same rate per hour as the men, were given shorter hours. They were, however, now working practically the same hours as the men. Ultimately the Mayor's proposal in its amended form was adopted.

MANCHESTER.

The trouble in connection with the Manchester tramway employees has at last been settled. It will be remembered that they maintained that they ought to have a higher war bonus than that awarded to them and to other tramway employees in Lancashire and Cheshire. Early in July the men in Manchester threatened to convert their "stay-in" strike to an actual stoppage of work, but this was defeated on a ballot being taken. It had been pointed out to them by the Ministry of Labour that a strike would be illegal, and a further arbitration was offered and accepted. The re-hearing took place before Sir George Askwith on July 16, and the decision was announced three days later to the effect that there was no reason for a departure from the award of June 11. That award increased the existing war wages advances from 6s. 6d. to 9s. per week for men and from 3s. 6d. to 6s. a week for women.

**The Derbyshire and Notts Tramways Act** received the Royal Assent in the House of Lords on July 11.

**Light Railways Acts.**—The Board of Trade have recently confirmed the following order made by the Light Railways Commissioners:—Darlington Light Railways (Amendment) Order, 1917, amending the Darlington Light Railways Order, 1902.

## LONDON COUNTY COUNCIL TRAMWAY ACCOUNTS.

YEAR ENDED MARCH 31, 1917.

A meeting of the London County Council on July 17 received and adopted the accounts submitted by the Highways Committee for the year ended March 31, 1917, together with a report by the general manager on the working of the undertaking.

The tramways system on March 31, 1917, extended over a total length of 149 street miles, of which 144½ miles were electric lines and 4·6 miles disused horse lines. During the year the only construction work undertaken was the doubling of certain portions of single line in Woolwich.

The following tables give the total income from the undertaking during the year, and the working expenses compared with the results in the three preceding years are given below:—

| YEAR ENDED MARCH 31. | 1917 | 1916 | 1915 | 1914 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Income ... ... ... | 2,552,203 | 2,339,291 | 2,399,487 | 2,268,669 |
| Working expenses* ... ... | 1,817,694 | 1,683,660 | 1,700,212 | 1,615,467 |
| Surplus on working ... ... | 734,509 | 655,631 | 699,275 | 653,202 |
| Deductions— | | | | |
| Debt charges— | | | | |
| Interest ... ... ... | 314,164 | 326,477 | 330,300 | — |
| Redemption ... ... | 429,851 | 425,908 | 405,605 | — |
| | 744,015 | 752,385 | 735,905 | 736,602 |
| Rent drawbacks, etc. ... | 7,551 | 6,797 | 1 | — |
| Income tax ... ... | 73,000 | 40,000 | 32,102 | 28,197 |
| Parliamentary expenses ... | 18 | 2,260 | 2,803 | 2,082 |
| Amount due to Metropolitan Electric Tramways, Limited, under through-running agreements ... | 1,521 | — | — | — |
| | 826,112 | 801,442 | 770,811 | 766,881 |
| Less tax deducted, interest on cash balances, rents, etc. | 102,945 | 72,061 | 38,363 | 25,153 |
| Total deductions from surplus | 723,167 | 729,426 | 732,448 | 741,728 |
| Balance ... ... ... | £11,342 (Surplus) | 73,795 (Deficiency) | 33,173 (Deficiency) | 88,526 (Deficiency) |

* Includes war service allowances, 1916-17, £110,155; 1915-16, £95,365; 1914-15, £42,209.

The renewals fund amounted on March 31, 1917, to £282,978 0s. 5d. Previous to the year under review there has been no payment into this fund since the year 1912-13, except interest paid on investments and amounts received from the London United Tramways, Limited. The general reserve fund on March 31, 1917, amounted to £72,390 10s. 9d. In the case of both funds the balances stated take no account of the depreciation of investments. Operating expenses were £1,694,609 6s. 9d. (excluding war service allowances of £110,155 12s. 10d. and certain special charges amounting to £12,928 19s. 9d.). The total number of passengers carried during the year was 586,127,976, and the number of car miles run was 49,478,973. The corresponding figures for 1915-16 were 545,423,397 and 47,879,675.

The following table gives particulars of the length of electric track open and receipts for the eleven years ended March 31, 1917:—

| Year ended March 31. | Average track miles. | Average receipts per track mile. | Gross passenger receipts. |
|---|---|---|---|
| | | £ | £ |
| 1907 ... | 40·66 | 19,929 | 810,320 |
| 1908 ... | 61·91 | 20,223 | 1,252,001 |
| 1909 ... | 77·94 | 19,752 | 1,539,434 |
| 1910 ... | 99·61 | 18,546 | 1,847,327 |
| 1911 ... | 116·98 | 17,925 | 2,096,914 |
| 1912 ... | 127·55 | 17,498 | 2,231,902 |
| 1913 ... | 132·49 | 16,179 | 2,143,559 |
| 1914 ... | 136·62 | 15,967 | 2,181,344 |
| 1915 ... | 140·66 | 16,516 | 2,323,130 |
| 1916 ... | 141·52 | 16,097 | 2,278,115 |
| 1917 ... | 141·67 | 17,479 | 2,476,309 |

CAPITAL EXPENDITURE.

Capital expenditure on the undertaking up to March 31, 1917, amounted to £13,570,119 1s. 11d., of which £53,542 4s. 4d. was incurred in the year 1916-17. The total amount of the debt incurred was £13,930,659 17s. 7d. The net debt on March 31, 1917, i.e., the debt outstanding, less the sinking fund in hand and less £120,216 in respect of the value of surplus land, was £9,141,826 6s. 8d.

The amount of capital expenditure, which up to March 31, 1917, had become obsolete owing to the electrification of horse tramways,

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was £2,024,687 15s. 3d. The amount still to be provided for in respect of the debt under this head is £943,740 15s. Certain other expenditure amounting to £117,829 15s. 4d. incurred in connection with electric traction, has also been rendered obsolete.

RATES AND STREET WIDENINGS.

The sum paid as rates on the permanent way amounted in 1916-17 to £64,413 7s. 10d., and represents an average relief to the rates of London of about ½d. in the £. The saving to the road authorities in consequence of the obligation of the Council to maintain the paving along the tramway routes is estimated by the Council's officers at about £140,000 a year on the present mileage. The amount chargeable to the tramways account in respect of the cost of effecting street improvements up to March 31 last was £774,039 12s. 7d.

## LONDON COUNTY COUNCIL TRAMWAYS REORGANISATION.

NEW APPOINTMENTS.

During the past few months the London County Council has accepted recommendations of the Highways Committee for carrying into effect certain proposals with regard to the organisation of the tramways department contained in the report presented to the Council on February 20 last, which was given in full in our issue of March 15.

Under the scheme adopted with the object of freeing the general manager, Mr. A. L. C. Fell, from an immense amount of detail work which, with the growth of the undertaking, had gradually been thrown upon him, it was arranged that the tramway department should be sectionalised, and that each section should be provided with executive heads and the necessary assistant officers.

ENGINEER OFFICERS.

The first step in giving effect to the new scheme was the appointment in May last of an electrical engineer to take charge of the work of the electrical branch. It had been decided that the salary assigned to the position should rise from £1,200 by annual increments of £50 per annum to £1,500. In response to advertisements forty-five applications were received. Twelve of the applicants who appeared best qualified were selected and seen, and later the committee had interviews with six of these candidates. As a result they recommended the appointment of Mr. Philip Lyle Riviere, an engineer on the staff of Messrs. Kennedy and Donkin, the consulting engineers, who had been intimately associated since 1901 in connection with his work for Messrs. Kennedy and Donkin with the electrification of the Council's tramways, and in particular at Greenwich generating station. The recommendation was accepted, and Mr. Riviere was appointed to the position on May 22 last.

The other positions in the electrical branch, as now arranged, are as follows:—

Superintendent of Greenwich generating station, to be styled power-station engineer; salary £500, increasing by four annual increments of £25 and two of £50 to £700 a year.

Resident electrical superintendent (southern section) to be styled distribution engineer (southern section); salary £400, increasing by annual increments of £25 to £600 a year.

Resident electrical superintendent (northern section) to be styled distribution engineer (northern section); salary £400, increasing, by annual increments of £25 to £600 a year.

On the recommendation of the Highways Committee the following appointments were made:—

Mr. E. W. Dickinson, superintendent of Greenwich generating station, to be the power station engineer at a commencing salary of £500.

Mr. E. L. Pope, resident engineer, to be distribution engineer (southern section).

Mr. T. L. Horn to be distribution engineer (northern section), the commencing salary of each to be £500 a year.

OFFICERS OF THE ROLLING STOCK BRANCH.

The scheme of reorganisation provided for the appointment of a rolling stock engineer, who should be the officer in charge of the rolling stock branch. The salary assigned to the position is £1,000, increasing by annual increments of £50 to £1,200 a year. In reply to an advertisement thirty-two applications for the appointment were received. The Highways Committee examined the applicants, and reported that they did not feel justified in recommending the appointment of any candidate to the position.

The principal officer in the rolling stock section is Mr. W. E. Ireland, rolling stock superintendent, whose salary has been £525 a year, and the committee recommended that, having regard to his experience and qualifications, he should, as a temporary arrangement, act as rolling stock engineer. As the position would place upon Mr. Ireland additional duties and increased responsibility, the committee recommend that he should receive a special allowance of £225 a year.

The reorganisation scheme provides that upon the appointment of a rolling stock engineer the present positions of rolling stock superintendent and assistant rolling stock superintendent should be abolished; that a position of rolling stock superintendent with a salary of £400 a year, increasing by annual increments of £25 to £600 a year, be established, and that a salary of £400, increasing by annual increments of £25 to £600 a year, be assigned to the position of superintendent of the central car repair depot.

The committee proposed that Mr. H. S. May, assistant rolling stock superintendent, should discharge temporarily the duties of rolling stock superintendent in the branch as reorganised, and while thus acting he should receive in addition to his salary of £325 a year an allowance of £75 a year.

It was also recommended that Mr. G. W. Knight, superintendent of the central car repair depot, should act temporarily in the position similarly designated under the reorganisation scheme, and while doing so should receive an allowance of £100 a year in addition to his salary of £300 a year.

OFFICERS OF THE PERMANENT WAY BRANCH.

Under the reorganisation scheme it was proposed that a permanent way engineer should be appointed, with a salary of £800, increasing by annual increments of £50 to £1,000 a year. In reply to an advertisement thirty-nine applications for the position were received, but the committee reported on July 31 that they did not feel justified in recommending the appointment of any candidate. They recommended that Mr. J. B. Welling, who has held the position of permanent way engineer since 1901, should be placed in the position of head of the permanent way branch as a temporary arrangement. His present salary is £600 a year, and it was agreed that he should receive an additional allowance of £100 a year.

Mr. J. R. Wignal, technical assistant in the general section, was assigned temporarily to the permanent way branch, and is to receive an allowance of £100 a year in addition to his salary of £340 a year.

CHIEF CLERK OF GENERAL BRANCH.

The reorganisation scheme provides for a chief clerk who would hold the position of head of the general branch. Mr. W. P. Farquharson, the general assistant, was appointed to this position on July 31. His salary is £600 a year, and at present he has supervision of most of the departmental sections which under the scheme will be organised in the general branch. The proposals for the reorganisation of the general branch the committee intend to submit to the Council as soon as possible, when the question of making a permanent appointment to the position of chief clerk will be considered.

DEVELOPMENT SUPERINTENDENT.

Mr. Theodore E. Thomas was appointed development superintendent on June 19. This appointment was also made in accordance with the reorganisation scheme. Mr. Thomas will take charge of the development and publicity section, as set out in the report, which provided that the minimum salary should be £500 per annum, rising by four annual increments of £25 and four of £50 to £800 per annum, but gave authority for an appointment to be recommended at other than the minimum salary.

In reply to an advertisement inviting applications for the position 38 applications were received. Nine of the candidates were selected and interviewed, and after personal interviews with four of the candidates the committee recommended the appointment of Mr. Thomas, who is at present commercial superintendent of the Metropolitan District Railway Company, the London General Omnibus Company, and allied companies. In view of his experience and his present position, the Highways Committee recommended that his salary under the Council should be £800 a year.

## THE INDUSTRIAL LEAGUE.

What may be described as the inaugural dinner of this new association took place on July 20. It proved an occasion of exceptional interest, and was in every respect a successful beginning of what we hope may come to be a strong and influential factor in the effort toward industrial harmony. Mr. Lee Murray presided, and among those who took part in the proceedings were Sir Albert Stanley, Mr. George S. Roberts, Sir Archibald Denny, Mr. G. Wardle, Mr. H. S. Scholey, Mr. F. Huth Jackson, and Mr. H. E. Blain.

Several of the speakers expressed their views with unusual frankness and sincerity. The League has gradually taken form during the past two years as the result of a series of meetings between Labour leaders and employers that have taken place generally at the Eccentric Club. The gatherings have afforded a free interchange of opinion, and unanimity has been arrived at on the necessity of friendly co-operation between employers and employees in order to secure the expansion of industry. It is recognised that if this is to be secured adequate remuneration and security must be given to the worker, who on his part must make a better return than in the past.

The League proposes to form district associations, which will get into touch with the workers themselves, and bring them into contact with manufacturers, and it hopes particularly to interest the small manufacturer. The work will be carried on as vigorously as the funds at the disposal of the League allow, and generous promises of support have been made to Mr. Scholey, the hon. secretary, whose address is 56, Victoria Street, and who will be glad to give all inquirers further explanations of the genesis and objects of the League.

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# FINANCIAL REPORTS AND MEETINGS.

**Browett, Lindley and Company, Limited.**—After providing for interest charges, and writing off £6,134 for depreciation, the net profit for 1916 was £9,450. The full year's dividend of 6 per cent. has been paid on the preference shares, and an extra distribution of 3 per cent. on account of arrears, and a dividend of 4 per cent. on the ordinary shares, leaving £3,540 undivided subject to excess profits.

**Egyptian Delta Light Railways.**—The receipts for the year ended March 31 were £232,927, compared with £192,027 in the preceding year, and the working expenses were £180,821, compared with £142,109. After providing for interest on debentures and fixed charges £106,807 remains. From this must be deducted the sum of £57,558 in suspense account. In consequence of the abnormal and increasing price of coal, stores, and materials, and the uncertainty for the future, the directors are unable to recommend a dividend.

**Stalybridge Tramways.**—The accounts of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board for the year ended March 31 last show that the total tramway revenue was £44,186, equal to 9·504d. per car-mile, while the working expenses were £29,498, or 6·345d. per car-mile. After paying capital charges, etc., and putting £2,828 to reserve, and crediting £7,000 raised from the Corporations concerned, there is a deficit of £5,202. At the end of the previous year the deficit was £6,734. The number of passengers was 10,016,837, and car-mileage 1,115,663.

**Metropolitan Railway Carriage, Wagon and Finance Company.**—The directors have announced that the Treasury has given its consent to the issue of shares represented by the proposed capitalisation of the part of the undivided profits and reserve and the balance of the present authorised capital in hand. The bulk of the issue, viz., £1,424,700, will be allotted to the shareholders. It was expected that the Treasury would give its consent, as the company is engaged directly in Government work and also in financing such undertakings as the British Westinghouse Electric and Manufacturing Company.

**North Melbourne Tramways.**—The report of the North Melbourne Electric Tramways and Lighting Company, Limited, states that the gross receipts show an increase from £33,462 to £40,358. The expenses—principally due to increased wages and high cost of materials and freight—increased from £21,730 to £28,888, the net revenue therefore being £11,470, as compared with £11,732 for the previous year. A contract has been entered into with the Melbourne City Council for the lighting of Flemington and Kensington. The necessary work of laying the mains and erecting the standards is being proceeded with as rapidly as possible.

**Brazilian Traction, Light and Power Company.**—The report for the year ended December 31, 1916, states that the surplus available for dividends was 5,674,642 dollars. After paying four dividends at 1 per cent. each, there is a surplus carried forward in profit and loss of 823,154 dollars. The decline in the surplus, as compared with the year preceding the war, is due to the fall in the exchange value of the milreis. Pending resumption of payment of dividends on the ordinary shares, the board propose to apply the surplus revenue from time to time in liquidating the floating indebtedness of the companies, and in providing for the necessary capital expenditure.

**Sunderland Corporation Tramways.**—The Sunderland Corporation Tramway receipts during the past year were the highest in the history of the undertaking, being £85,180, or over £6,000 more than the preceding year, while the total number of passengers carried was nearly 2,000,000 more than in any other year, being 21,711,489. Compared with 1898, the first year of the municipal undertaking, those figures show a great advance, the traffic receipts that year being £17,578, and the passengers carried a little over 3,000,000. The total income for the year was £85,513, and from the net profit £5,000 has been given to the relief of the rates, bringing the total sum applied in that way to £62,027.

**Improvement at Walthamstow.**—The twelfth annual report on the Walthamstow Urban District Council Tramways has been presented by the manager, Mr. Wm. Murray. It shows that for the year ended March 31 last the total receipts were £55,770, as compared with £45,874 in the preceding year. The net balance, after meeting all expenses, including repayment of loan and interest (£9,909) and war bonus and separation allowances (£1,700), was £6,817, against £816 in 1916. The revenue per car-mile was 11·86d., an increase of 1·45d. The passengers numbered 12,367,758, a decrease of 2,320,685. The mileage run was 1,128,029, an increase of 69,460. The highly favourable financial results compared with previous years is attributed to the abolition of halfpenny fares, which, on the recommendation of the manager, was carried out at the beginning of the financial year.

**Shanghai Electric Construction Company.**—The accounts for the year 1916 reveal a profit of £48,123, which compared with £31,084 in the previous year. Preliminary expenses account has been reduced by £5,000, and £10,000 has been carried to reserve for renewals. The dividend on the ordinary shares is 10 per cent. for the year, less income tax, leaving £2,510 to be carried forward. The loss by exchange on subsidiary coinage was £38,751. The net traffic receipts for the four months of 1917 show an improvement. The rolling stock now consists of 70 cars, 15 trailer cars having been added. Including seven railless cars, which are working successfully on one mile of route, there are 167 passenger vehicles. The directors think that considerable expansion in business can be obtained from the extension of railless car routes, and powers are being sought from the Municipal Council for the purpose.

**Coventry Corporation Tramways.**—Councillor Pugh, chairman of the Tramways Committee, in presenting the report of the department to the Town Council, said that there was a surplus of £7,667, and after writing off £1,033 as motor omnibus capital expenditure, and £388 for other items, there was a balance of £6,245, which would be transferred to the reserve and renewals fund. Owing to the increases in wages and the enhanced cost of material, it was impossible to recommend the allocation of any sum to the relief of rates this year. Considering all the difficulties of carrying on with the shortage of labour and material, he thought that the travelling public had much reason for gratitude to the manager and staff of the department. He also expressed appreciation of the splendid services rendered by the women. He had to warn the public that the increased wages would inevitably involve some readjustment of the tramway fares. Councillor Wale, in seconding the adoption of the report, remarked that the traffic problem of the city was one which must require very serious consideration in the future. He contended that by pursuance of the financial policy inaugurated by Councillor Pridmore the Council would confer a great benefit on the citizens, and ultimately be able to provide a tramway system second to none.

**Bombay Electric Supply and Tramways Company.**—The report for 1916 states that the total revenue from all sources, including the amount represented by sale of current to the tramways, amounted to £373,467, an increase of £62,697, or 20·17 per cent. The total expenditure amounted to £156,688, an increase of £14,597, or 10·27 per cent. The net receipts from the year's working aggregated £216,779, an increase of £48,100, or 28·52 per cent. over those for the previous year. After deducting debenture interest, depreciation, etc., there remains £114,373, and £9,602 was brought in, making £123,976. The directors now recommend a dividend for the year on ordinary shares at the rate of 10 per cent. per annum. They propose writing down securities to the extent of £6,666, and to pay a bonus of one month's pay to the company's officers and employees, leaving £5,214 to be carried forward. The gross receipts from the traction branch amounted to £198,765, against £172,051, an increase of 15·53 per cent. The working expenses amounted to £87,826, against £70,665, an increase of 10·24 per cent. The balance of receipts over expenses in respect of the year's working amounted to £110,939, against £92,387 for the previous year, an increase of 20·08 per cent. The gross receipts of the supply department, including the amount represented by sale of current to the tramways, amounted to £171,167, against £138,021. The working expenses amounted to £62,293, against £58,132. The net receipts aggregated £108,874, an advance of 36·28 per cent.

**General Electric Company.**—Presiding at the annual meeting on July 17, Mr. H. Hirst moved the adoption of the report, which showed that as compared with the previous year the gross profit had increased by 35 per cent., and the net profit 25 per cent. The ordinary dividend remained unchanged at 10 per cent. The sum of £40,000 has again been transferred to the reserve fund, and the total of this fund amounted to £400,000, with the addition of £100,000 placed to special reserve to cover pre-war contingencies. The grants to dependants of men on active service absorbed £11,500. All the allied and subsidiary undertakings have continued to do well with the exception of one or two which have been adversely affected by the state of war. The results for the last five years are set out below:—

| Year ended Mar. 31. | Gross profit. | Net profit. | Ord. div. | Special appropriatn's. | Depreciation allowance. | Carry forward. |
|---|---|---|---|---|---|---|
| 1913 ... ... | 145,300 | 93,200 | 10 | 33,000 | 24,500 | 32,300 |
| 1914 ... ... | 157,900 | 101,400 | 10 | 33,000 | 24,300 | 36,700 |
| 1915 ... ... | 164,900 | 114,300 | 10 | 27,500 | 18,900 | 36,700 |
| 1916 ... ... | 196,300 | 156,300 | 10 | 53,000 | 19,300 | 48,100 |
| 1917 ... ... | 265,200 | 195,700 | 10 | 62,000 | 30,500 | 89,800 |

In the course of an interesting speech Mr. Hirst said that the total net profit had increased by about £70,000, of which £30,000 was on trading account, and about £40,000 represented increase in revenue from investments. Their investments account, which had shown a steady yield of about 10 per cent., had increased by, roughly, £350,000, due mainly to their acquisition of shares in the Osram-Robertson Lamp Works, Limited, of which in the past thay had been only part-owners. He hoped the ordinary shareholders would approve their refunding this year the income-tax to preference shareholders by way of a special bonus. The ordinary shareholders were reaping the full benefit of the prosperity of the company by an increased dividend and by the appreciation of their shares. Of all the changes that would result from war in this country those in the electrical industry would be the most drastic. Replacement and reorganisation after the war would be a tremendous task for the existing electrical companies. War had taught the country the necessity of home production.

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**Imperial Tramways Company.**—Presiding at the ordinary meeting of this company in Bristol on June 27, Mr. Samuel White moved the adoption of the directors' report, and made feeling reference to the death of his brother, Sir George White, former chairman of the company. With regard to the Middlesbrough, Stockton, and Thornaby Tramways, though they carried more than half a million additional passengers, and their receipts exceeded £70,000 for the first time, there had been a considerable increase in the working expenses, with the result that the net revenue was over £1,000 below that of the previous year. The greatest credit was due to Mr. Freshwater, their manager, for the excellent manner in which he had discharged his trying duties. The Corris Railway had suffered from the abnormal conditions of the times. They had begun to build up a tourist traffic, but that had been knocked on the head. Their income for the year was £23,073, of which £14,228 was derived from the working of the Middlesbrough undertaking and the balance from dividends upon their other investments. It was sufficient to enable them to pay the 6 per cent. dividend upon their preference shares, interest upon their debenture stock, a dividend of 2 per cent. upon the ordinary capital, and to carry forward £123 19s. 10d. to the next account. When they returned to normal times there was no reason why things should not improve, and their business become extremely profitable. They could look forward with some degree of confidence to a better return upon their investments in the future. The report was adopted.

**Southampton Corporation Tramways.**—The results for the year ended March 31, 1917, as shown by the report of the general manager and engineer, Mr. W. T. Robson, were very satisfactory considering the special difficulties that prevailed. The abnormal prices of materials and heavy special war expenditure have, as elsewhere, constituted a great handicap. The receipts, which amounted to £88,183, an increase of £9,355, again formed a record. The gross balance of £16,669 has been appropriated as follows:—Sinking fund charges, £7,399; proportion of cost of new car, £796; third party, insurance fund, £256; depreciation and renewals fund, £5,218; and contribution to rates, £3,000. A summary of the accounts for the past five years is appended:—

| Year ended March 31. | 1917. | 1916. | 1915. | 1914. | 1913. |
|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ |
| Total revenue ... ... | 88,183 | 79,828 | 71,038 | 70,598 | 66,534 |
| Working expenses ... ... | 56,745 | 48,617 | 48,617 | 46,521 | 47,049 |
| Profit on working ... ... | 27,177 | 26,854 | 20,732 | 24,077 | 19,485 |
| Interest ... ... ... | 10,508 | 9,123 | 8,336 | 7,708 | 7,675 |
| Sinking fund charges ... | 7,399 | 7,614 | 7,557 | 7,433 | 7,241 |
| Depreciation fund ... ... | 5,218 | 4,460 | 5,000 | 7,118 | 5,000 |
| Special expenditure ... ... | 1,052 | 1,939 | — | — | 1,422 |
| Contribution to rates ... | 3,000 | 5,000 | 5,134 | 2,360 | — |
| Passengers carried ... ... | 17,718,810 | 15,494,366 | 13,265,715 | 13,162,224 | 12,475,793 |
| Fare per passenger ... ... | 1·17d. | 1·21d. | 1·23d. | 1·23d. | 1·23d. |
| Car-mileage ... ... ... | 1,813,547 | 1,636,103 | 1,703,032 | 1,543,941 | 1,533,638 |
| Receipts per car-mile ... | 11·67d. | 11·71d. | 10·01d. | 10·97d. | 10·41d. |
| Expenses per car-mile ... | 8·07d. | 7·77d. | 7·09d. | 7·23d. | 7·36d. |
| Ratio of expenses ... ... | 64 | 60 | 68 | 66 | 71 |

**Burnley Corporation Tramways.**—Mr. Henry Mozley, general manager, in his report for the year ended March 31, 1917, states that there was a profit on working of £25,352, slightly less than the amount in the previous year. There was an increase in traffic receipts of £4,064, although the car-mileage remained practically the same. Ordinary discount tickets and students' periodical tickets were abolished, but too late to have much influence on the results of the year. Wages showed an increase of more than £4,000 per annum above the amount at the beginning of the war. Within past three years £10,011 have been contributed as allowances to employees with the forces, income-tax has increased by £3,000, and there has been a like increase in wages. But for the conditions arising out of the war, the financial position of the undertaking would have been a great advantage to the ratepayers from a profit-earning point of view. The long continuance of the war and the demands of the military authorities continue to affect the staff seriously, but the efficiency of the service is surprising considering the conditions. The following summary gives a comparison of the results for the past five years:—

| Year ended March 31. | 1917. | 1916. | 1915. | 1914. | 1913. |
|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ |
| Total revenue ... ... | 87,421 | 83,238 | 78,466 | 88,316 | 79,890 |
| Working expenses ... ... | 58,604 | 53,572 | 55,833 | 62,948 | 49,430 |
| War allowances ... ... | 3,211 | 4,312 | 2,483 | — | — |
| Profit on working ... ... | 25,352 | 25,606 | 20,150 | 25,367 | 30,460 |
| Interest ... ... ... | 6,401 | 6,552 | 6,797 | 6,938 | 5,661 |
| Sinking fund ... ... | 8,716 | 8,497 | 8,284 | 7,728 | 6,491 |
| Rent for tramways worked | 1,546 | 1,752 | 1,889 | 1,941 | 2,061 |
| Income-tax on profits ... | 3,720 | 2,541 | 1,515 | 1,072 | 892 |
| Reserve fund... ... ... | 5,222 | — | — | — | 5,790 |
| Borough fund ... ... | — | 6,010 | 1,664 | 7,687 | 8,750 |
| Passengers carried ... ... | 17,068,753 | 16,946,677 | 15,867,699 | 17,668,834 | 15,949,359 |
| Fare per passenger ... ... | 1·21 | 1·15 | 1·16 | 1·18 | 1·18 |
| Car mileage ... ... ... | 1,548,902 | 1,546,389 | 1,644,712 | 1,754,811 | 1,449,647 |
| Units per car-mile ... ... | 2·15 | 2·06 | 2·20 | 2·22 | 2·11 |
| Power cost per car-mile ... | 2·677 | 2·786 | 2·749 | 2·630 | 2·556 |
| Traffic receipts per car-mile | 13·48d. | 12·88d. | 11·42d. | 12·04d. | 13·19d. |
| Expenses per car-mile ... | 9·08d. | 8·31d. | 8·15d. | 8·62d. | 8·18d. |
| Ratio of expenses ... ... | 67·04% | 64·36% | 67% | 71·39% | 61·85% |
| Number of cars in stock ... | 67 | 67 | 67 | 67 | 57 |

**British Thomson-Houston Company.**—At the twenty-second ordinary general meeting of this company in London on July 30, Mr. H. C. Levis, chairman and managing director, presided, and in moving the adoption of the report and accounts for 1916, said that the total number of the company's employees who had joined His Majesty's forces was 1,309. The number who had fallen in the service of their country was 152. The number holding commissions was 102, many of whom had received decorations. The directors did not recommend the payment of dividends, as it had been deemed wise to use the surplus profits for further depreciation of the goodwill and plant accounts. Last year the goodwill account was depreciated by about £30,000, bringing it down to an even £100,000, and the plant account by £60,000. This year they were able to depreciate the goodwill by an additional £40,000, leaving the net amount £60,000. In regard to the plant, they expended during the year £88,535, but they had made a further depreciation for the year 1915 of £12,093, being an additional amount allowed by the Government, and for the year 1916 they had allocated £103,715, making the total writing off for the year nearly £116,000. Their holdings in shares and debentures of other companies were now valued very conservatively. The profit for the year of £359,364, after deducting all expenses and charges of every kind, excepting only interest, involved heavy payments to the Government, but they were glad that circumstances were such that their contribution could be so large. Last year they made a reserve of £25,000 to take care of possible depreciation in raw material; this year they wrote it back, and used it for other depreciations, because it was not required, and due to the fact that it was proposed under the Finance Bill that they should have two years within which to liquidate their stock of raw material, they felt there was little danger of making a loss in this connection. Their debentures had depreciated in volume by the amount drawn during the year. Their loan from the General Electric Company, of New York, had increased by £57,000, and the amount under sundry creditors, retentions, etc., was up £126,000, having increased from £300,684 to £426,910, but on the other side the item of apparatus finished and in process of manufacture had increased £124,000, sundry debtors, retention moneys, etc., had increased £135,000, and the cash balance had just doubled, increasing from £63,000 to £126,000. It would be interesting could he make a statement relative to the character of the work which they were carrying out, but it was impossible to say more than that practically their entire output was directly or indirectly for Government requirements. Mr. W. C. Lusk seconded the motion, and it was agreed to. Messrs. C. A. Coffin and E. W. Rice, the retiring directors, were re-elected.

**Portsmouth Corporation Tramways.**—The annual report of the general manager, Mr. W. R. Spaven, for the year ended March 31, 1917, shows that the total revenue for the year was £136,871, an average of 14·204d. per car-mile, as compared with £127,546, or 14·101d. per car-mile, in the previous year. After deducting working expenses, grants to dependants of employees serving with the forces, war bonuses, and adding interest on credit balances, there is a balance on working of £64,583, as compared with £66,218 for the preceding year. After payment of interest, income-tax, etc., there is a net balance of £18,680. The sum of £14,000 is transferred to the aid of the rates, £6,380 to the renewals fund, £1,381 to reserve and insurance fund, £188 to capital outlay, and £4,000 is reserved for the Cosham improvement. The traffic revenue is regarded as highly satisfactory, in view of the fact that the general holidays were not observed at Whitsun and August, and that during the winter months the services were much curtailed. A summary of the accounts for the past year and the four preceding years is appended:—

| Year ended March 31. | 1917. | 1916. | 1915. | 1914. | 1913. |
|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ |
| Total revenue ... ... | 136,871 | 127,546 | 123,991 | 116,990 | 109,832 |
| Working expenses ... ... | 73,166 | 62,079 | 58,658 | 57,620 | 52,227 |
| Profit on working ... ... | 63,705 | 65,467 | 65,333 | 59,370 | 57,605 |
| Interest on credit balances | 878 | 751 | 780 | 829 | 765 |
| | £64,583 | £66,218 | £66,113 | £60,199 | £58,370 |
| | £ | £ | £ | £ | £ |
| Interest ... ... ... | 21,667 | 21,672 | 21,643 | 21,593 | 20,875 |
| Sinking fund ... ... | 18,061 | 18,055 | 18,455 | 18,263 | 17,462 |
| Income-tax on profits ... | 6,175 | 3,503 | 1,940 | 1,301 | 964 |
| Allowance, renewals, 1902-9 | — | 1,211 | — | — | — |
| | £45,903 | £44,441 | £42,038 | £41,157 | £39,301 |
| | £ | £ | £ | £ | £ |
| Net profit ... ... ... | 18,680 | 21,777 | 24,075 | 19,042 | 19,069 |
| Balance brought forward ... | 7,278 | 9,569 | 10,702 | 11,374 | 8,067 |
| Contribution to rates ... | 14,000 | 13,000 | 10,000 | 5,000 | 4,000 |
| Reserve and renewals ... | 11,769 | 9,060 | 10,186 | 11,123 | 11,762 |
| Contribution to capital ... | 188 | 2,006 | 5,023 | 3,591 | — |
| Balance carried forward ... | Nil | 7,278 | 9,568 | 10,702 | 11,374 |
| Passengers carried ... ... | 31,798,562 | 29,338,918 | 27,554,194 | 26,266,342 | 24,520,647 |
| Fare per passenger ... ... | 1·018d. | 1·033d. | 1·061d. | 1·052d. | 1·052d. |
| Car-mileage ... ... ... | 2,312,391 | 2,170,778 | 2,438,621 | 2,506,058 | 2,155,508 |
| Units per car-mile ... ... | 1·417 | 1·238 | 1·139 | 1·103 | 1·206 |
| Power cost per car-mile ... | ·911d. | ·760d. | ·549d. | ·576d. | ·582d. |
| Receipts per car-mile ... | 14·204d. | 14·101d. | 12·201d. | 11·204d. | 12·229d. |
| Expenses per car-mile ... | 7·017d. | 6·556d. | 5·599d. | 5·518d. | 5·815d. |
| Ratio of expenses ... ... | 49·39 | 46·49 | 45·88 | 49·25 | 47·55 |
| Total track mileage ... ... | 34 5/8 | 34 3/8 | 34 5/8 | 34 1/16 | 30 3/4 |
| Number of cars in stock ... | 100 | 100 | 100 | 100 | 100 |



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**London United Tramways, Limited.**—An adjourned meeting of the holders of the first mortgage debenture stock was held on July 26 to consider the report of the committee appointed on June 13 last. Mr. W. N. Mattinson, K.C., made a statement concerning the work done by the committee which had inquired into the financial circumstances of the company. He said he was not in a position to report fully as to all the causes of its present position, but the greatly increased cost of working due to the war was largely responsible for it. There were a number of questions relating to the physical state of the undertaking, the further capital expenditure required to maintain it, its relations with other undertakings, etc., which, in order to understand properly, required an intimate knowledge of tramway construction and working. The committee had asked for information on a number of specific points, and that had been given them; but the committee was of opinion that expert advice should be obtained without delay. The only course open to the committee by which they could hope at once to get first hand the information required was by electing to the board two gentlemen to be nominated by the debenture holders. The present board had, however, declined the committee's request, but they gave an assurance that they would give every information required by the committee, and they had also formulated in a somewhat more definite form their tentative proposals. The committee recommended that the bondholders should authorise them to incur all necessary expenses in obtaining professional and other advice. Mr. Mattinson moved a resolution to this effect, and this was seconded and agreed to.

## DIVIDENDS.

**Sao Paulo Tramway, Light and Power Company** have declared a dividend of 2½ per cent. on the common stock.

**Mather and Platt, Limited.**—An interim dividend on the ordinary shares of 5 per cent. for the half-year, less income-tax, has been declared.

**Hong Kong Tramway Company** announces a dividend of 9 per cent., less tax (interim). Last year the corresponding dividend was 7 per cent.

**Bristol Tramways and Carriage Company.**—The directors have declared an interim dividend at the rate of 5 per cent. per annum for the past half-year.

**City of Buenos Aires Tramways.**—The directors of the City of Buenos Aires Tramways Company (1904) have declared a dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less tax, for the three months ended June 30.

**Liverpool Overhead Railway.**—The company announce a dividend for the past half-year at the rate of 2½ per cent. per annum on the ordinary shares. Similar distributions were made for the corresponding periods of each of the four preceding years.

**London and Suburban Traction.**—The directors of the London and Suburban Traction Company announce that they do not propose to pay an interim dividend on the preference shares for the half-year to June 30, 1917. Last year 2½ per cent. was paid.

**London General Omnibus.**—The directors of the London General Omnibus Company have declared an interim dividend for the half-year ended June 30 of 4 per cent., free of income-tax, on the ordinary shares. A year ago the interim dividend was at 5 per cent.

**London Electric Railway.**—The directors of the London Electric Railway Company have declared a dividend for the past half-year at the rate of 2 per cent. on the 4 per cent. preference stock, and ¾ per cent. on the ordinary shares. The rates are the same as a year ago.

**City and South London.**—The directors of the City and South London Railway Company have declared dividends of 2½ per cent. on the 5 per cent. preference stocks, 1891, 1896, 1901, and 1903, and ¾ per cent. on the ordinary stock for the six months ended June 30. The rate was the same a year ago.

**Dublin United Tramways.**—The directors propose to declare an interim dividend for the half-year ended June 30, 1917, at the rate of 6 per cent. per annum, less income-tax, on the preference shares, and at the rate of 4 per cent. per annum, less income-tax, on the ordinary shares. The dividend warrants will be sent out on August 4.

**Metropolitan District Railway.**—The directors of the Metropolitan District Railway Company have declared interim dividends for the six months ended June 30 on the 4 per cent. guaranteed stock of 2 per cent., on the first preference stock of 2¼ per cent., and on the second preference stock of 1½ per cent. The dividends are the same as a year ago.

**Central London Railway.**—The directors of the Central London Railway Company have declared interim dividends for the six months ended June 30 on the undivided ordinary stock of 1¼ per cent., and on the preferred ordinary stock of 2 per cent. There is no change in the dividend as compared with the corresponding half of the previous year.

**Underground Electric Railways.**—The directors of the Underground Electric Railways Company of London, Limited, announce that interest on the 6 per cent. first cumulative income debenture stock will be paid on September 1, less tax, at 3 per cent., and coupon No. 19 off the 6 per cent. income bonds will be paid, free of tax, at 2 per cent. For the second half of last year the rate was the same.

## PERSONAL.

**Mr. T. Potts** has been appointed traffic manager of Doncaster Corporation Tramways.

**Mr. A. S. Channon,** electrical engineer of Grimsby, has been granted an additional war bonus of £50 per annum.

**Mr. R. L. Horsfield,** manager of Walsall Corporation Tramways, has been granted an increase of £100 a year in salary.

**Mr. W. J. Best** has been appointed staff engineer at Kelham Island power station, Sheffield, at a salary of £180 per annum.

**Mr. S. T. Allen,** electrical engineer of Wolverhampton Corporation, has been granted an increase in salary from £600 to £800 a year.

**Mr. Robert Caven,** manager of the Bessbrook and Newry Tramway Company, has retired on a pension after ten years' service.

**Mr. J. W. Dawson,** assistant electrical engineer of Bradford Corporation tramways, has been granted an increase in salary.

**Mr. Martin Hamilton** has been appointed manager of the Bessbrook and Newry Tramway Company, in succession to Mr. Robert Caven.

**Mr. F. A. Fitzpayne,** general manager of Leith Corporation Tramways, has received an increase of £100 in his salary, to be paid in two annual increments of £50.

**Mr. Henry Mozley,** general manager of Burnley Corporation Tramways, has been voted an increase in salary by the Tramways Committee from £450 to £525 per annum.

**Mr. William M. Murphy,** chairman of the Dublin United Tramways Company, accepted the invitation of the Government to act as one of their representatives at the Irish Convention, which was convened at Trinity College, Dublin, on July 26.

**Mr. E. A. Prosser,** general manager of the Cardiff Railway Company and of the Rhymney Railway Company, has been appointed also general manager of the Taff Vale Railway Company, and it is expected that the working of these lines will be unified.

**Mr. T. B. Murray,** a managing director of the Albion Motor Car Company, Limited, of Scotstoun, Glasgow, has received the degree of D.Sc. from Edinburgh University for his thesis, "Some Research and Inventions in Hydraulic, Electrical, and Motor Vehicle Engineering."

**Mr. Bromley Holmes** has been appointed chairman of a subcommittee specially appointed to deal with the supply of electrical energy to the Mersey Docks and Harbour Board. This committee will consider all questions of electric supply charges and extensions before they are submitted to the tramways and electric power and lighting committee.

**Mr. Lorenzo W. Migotti,** who for the past nine years has been electrical engineer to the Bahia Blanca North Western Railway and manager of the South American Light and Power Company, and who was formerly with the Underground Railways of London, has accepted the post of chief engineer to the Electric Supply Company of Rosario de Santa Fe, Argentine Republic.

**Mr. G. F. Glass,** on the recommendation of Mr. I. Bulfin, the general manager, has been appointed traffic superintendent of Bournemouth Corporation tramways, at a salary of £180 per annum, rising by annual increments of £20 to £220, in succession to Mr. R. O. Baldwin, who, as recently announced, has been appointed manager of Exeter Corporation Tramways. **Inspector Rushton** succeeds Mr. Glass as chief traffic clerk.

**Mr. E. Hatton,** general manager and engineer of Newcastle Corporation Tramways, who had been absent for some weeks owing to a severe illness, received a cordial welcome from the chairman of the Tramways Committee, Mr. Richard Mayne, at a meeting on July 6. Sir J. Baxter Ellis, alluding to the chairman's services, said that he deserved the thanks of the city for the able way he had managed the heavy traffic in race week in the absence of Mr. Hatton.

**Mr. William Marsh,** engineer and manager of Brighton Corporation Tramways, has been recommended by his committee for an increase of salary from £400 to £500 per annum. The peculiar condition is attached to the increase that the amount of it shall, during the time that Mr. Marsh is acting as an assistant director of shipyard labour, be reduced by an amount equivalent to the pecuniary benefit derived by him from the allowance for expenses to be made to him by the Government.

**Mr. E. S. Rayner,** who recently resigned his position as tramway manager and engineer of Doncaster Corporation to accept an important appointment in the Admiralty, has been presented with a gold wristlet watch in the presence of a large gathering of the officials and staff. Mr. G. A. Roberts made the presentation and expressed the cordial goodwill and best wishes of the staff. At a meeting of the Tramways Committee, the chairman, Councillor Balmforth, congratulated Mr. Rayner and wished him success in his new sphere of work.

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### WITH THE FORCES.

**Capt. P. H. di Marco, R.E.,** pre-war manager of the Barnsley and District Electric Tramway Company, Limited, after nearly three years at the front, during which he was twice wounded, is now in a military hospital in England.

**Distinctions for Tramway Soldiers.**—Major F. J. Chapple, power and rolling stock superintendent of the Potteries Electric Traction Company, who is serving in France with an artilley unit, has been awarded the D.S.O. Regimental Sergeant-Major H. Parker, Royal Dublin Fusiliers, and Corporal J. Cartlidge, former employees of the company, have been granted the Military Cross and the Military Medal respectively.

**Tramway Employees Serving with H.M. Forces.**—The Liverpool Tramways Department has been notified of the recent honours conferred for conspicuous bravery in the field on the following tramway employees now serving with H.M. Forces, viz. :—Military Medal: W. N. Fortune, E. Pritchard, J. E. Downes, T. J. Jones, and F. Shields, all serving with the Forces in France. Meritorious Service Medal: D. Collum, serving with the Mesopotamian Forces. Nine other employees of the department have received at different times distinctions for bravery in the field, viz. :—Capt. S. Carty, Military Cross and Medal; W. Broster, Military Medal and Distinguished Conduct Medal (killed in action); E. T. Pryce, J. H. Evans, and G. J. Lazell, Military Medal; R. Williams and A. R. Jones, Distinguished Conduct Medal; C. F. Claxton, D.C.M. and Military Medal; and T. Muncaster, Meritorious Service Medal. A large number of employees have also been mentioned by their respective commanding officers for conspicuous gallantry.

## CONTRACTS AND ORDERS.

**Derbyshire County Council** propose to purchase six trailer wagons, the estimated cost being £650.

**Messrs. Mossay and Company** are to supply an electric vehicle to Dewsbury Town Council at £911.

**Glover and Company, Limited,** are the successful tenderers to Leicester Town Council for cables at £3,425.

**Siemens Brothers and Company, Limited,** are to supply a 1,000 K.W. rotary converter at £3,100 to Leicester Corporation.

**Derby Corporation** have accepted the tender of the British Thomson Company for a rotary converter and switch gear at £2,314.

**The British Insulated and Helsby Cables, Limited,** have an order from Derby Town Council for two miles of overhead wires.

**British Westinghouse Electric and Manufacturing Company** are to supply a 5,000-KW. generating set to Shoreditch Borough Council at £26,538.

**The General Seating Company, Limited,** have received an order from Derby Corporation Tramways for one hundred illuminated route number indicators.

**The Shoreditch Electricity Committee** have recommended the acceptance of the tender of the British Westinghouse Company, Limited, for turbo-alternator plant at £26,538. Nine tenders were received.

**Glasgow Tramways Committee** have accepted a tender from the Whitecross Company, Limited, Warrington, for the supply of span wire. The Electricity Committee have accepted the tender of Babcock and Wilcox, Limited, for additional coal-handling plant required at St. Andrew's Cross Station.

**Walthamstow Council** have accepted the following tenders:—Overhead line material, Fleming, Birkby and Goodall, Limited; trolley wire, Frederick Smith and Company, Limited; cable, W. T. Henley's Telegraph Works Company, Limited; switchgear, the British Thomson-Houston Company, Limited.

**Headingley Tramways, Leeds.**—The Corporation have accepted the following tenders for the reconstruction of the tramways in Victoria Road, Headingley, Leeds:—Section 1: J. Speight, tramway work, £508 2s. 6d.; highway work, £277 18s. 4d. Section 2: D. Speight and Sons, tramway work, £508 15s.; highway work, £277 18s. 4d.

**The Newport Electricity Committee** have accepted the following tenders for plant extensions:—British Westinghouse Electric and Manufacturing Company, Limited, electrical equipment for induced draught plant; Musgrave and Company, Limited, induced draught plant; Davenport Engineering Company, cooling towers; E. Green and Son, Limited, additions to fuel economiser.

**London County Council Tramways.**—The Highways Committee of the London County Council have accepted the following tenders:—Pinchin, Johnson and Company, Limited, baking and air-drying insulating varnish, £65; Jenson and Nicholson, Limited, finishing insulating varnish, £230; Dick, Kerr and Company, Limited, for the transfer, including dismantling and re-erection of two rotary converters, with transformers, from Greenwich generating station to Woolwich, £265; Heenan and Froude, Limited, patterns of tramcar trucks of the type principally used on the Council's tramways, £100; Alfred Clare and Company, a motor-driven taping machine for re-winding armature coils, £17 14s. 4d.; Edgar Allen and Company, Limited, 75 driving wheel centres for tramcars; Hadfields, Limited, 75 driving wheel centres for tramcars; William Beardmore and Company, Limited, 100 driving wheel axle forgings for tramcars, at £4 17s. 6d. each. The following orders in connection with Greenwich generating station have been placed:—Babcock and Wilcox, Limited, 8,000 stoker links for boilers at £277 15s., and 4,000 links for chain grate stokers at £133 17s. 6d.; P. and W. Maclellan, Limited, Glasgow, six top plates for repairing the ashpits, at £4 19s. 6d. each; W. and T. Avery, Limited, overhaul of two coal-weighing machines, £28 16s. 3d.

## TRAMWAY AND LIGHT RAILWAY NOTES.

### BARKING.

New Lease of Tramways to Ilford.

Representatives of the Ilford and Barking Councils have reached a provisional agreement for the renewing of the lease of the Barking tramway tracks. The period will be three years from June 1, 1917, and the annual rental will be £1,250. The price to be paid for energy supplied from the Barking Council will be 1⅝d

### BIRMINGHAM.

Road Improvements and Tramway Extension.

Before next autumn a report will be presented to the Corporation by a joint committee of the Public Works, Tramways, and Town Planning Committees, recommending road widenings, tramway extensions, the construction of ring roads, and the linking up of main or arterial thoroughfares. The report will emphasise the need for concerted action, and apart from street widening on an extensive scale, the committee have prepared a plan which connects up one important street with another, and one district with another, with a view ultimately of establishing a much enlarged cross-city tramway system. The immediate sanction of the Council will be asked to a portion of the scheme relating to the acquisition of frontage sites on main arteries. Large numbers of leases are falling in, and the joint committee desire to acquire, as opportunities occur, plots of land, so that ultimately they may re-arrange the street lines with the object of giving a greater width of carriage-way.

### CHESTER.

Difficulty of Permanent Way Maintenance.

Reports received from the city surveyor and the electrical engineer on the condition of the tramways track and overhead equipment at Chester have been ordered to be sent to each member of the Corporation, in order that the whole matter may be considered at a meeting of the Council in committee. The Sheriff, on obtaining the consent of the Corporation to this course, said that the reports were made to the Tramways Committee on November 25 and February 1 last, and the contents were so important that the committee considered the responsibility for taking action should rest with the Council. The matter was a source of danger to the city. Nothing could be done at present to remedy it, but the Council could consider what was to be the future policy of the Tramways Committee. Alderman J. Jones, chairman of the committee, said they were anxious to get the track restored, but it was an utter impossibility, and even after the war they would not be able for some time to make a thorough job of it. The committee were doing as much repairs as possible, and if anything further in that direction could be suggested they would adopt it.

### DUBLIN.

Government Take Over Dublin and Blessington Line.

The President of the Board of Trade, in taking over this undertaking, has decided that the financial situation for the ratepayers shall be as in 1913. In that year they were called on to pay in the County Dublin guaranteeing area a rate of from 3d. to 4d. in the £, and in the County Wicklow from 4d. to 6d. For the current year the ratepayers paid in the County Dublin area 2s. 4d., and in the County Wicklow 3s. 6d. in the £. Replying to a question by Mr. Clancy in the House of Commons, Mr. Roberts stated that the quantity of petrol used by the Dublin and Blessington Tramway Company had been reduced on June 1 from 1,100 to 734 gallons a month—a reduction of one-third, but as a result of representations the allowance had been increased to 890 gallons.

### GREENOCK.

Stage Numbering.

After a trial extending over some years, the Greenock and Port Glasgow Tramways management has abolished the system of indicating stopping places by numbers on the tickets. The system was confusing to strangers, and was never understood by local people. A reversion to the use of street names has been effected.

### HALIFAX.

Overturned Car.

On July 15 a car of the Halifax Corporation Tramways was overturned, one passenger being killed and 37 injured. The car was running down Ambler Thorn Hill when it got out of the control of the driver and rushed to the bottom of the hill, a distance of 150 yards. On a curve there it jumped the rails, and after running about 25 yards over the setts was overturned. The driver was practically unhurt, but the conductress received injuries to the head. The car was a new one, and the cause of the accident is at present unknown.

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### HUDDERSFIELD.

TRACK DOUBLING—NEW CARS—RULE OF THE FOOTPATH.

At a meeting of the Tramways Committee on July 17, Mr. B. H. Wilkinson, the manager, reported on the advisability of doubling the track of the Bradley section, and he was instructed to apply to the Ministry of Munitions for authority to purchase the necessary material. The Corporation Tramways have recently received six new cars constructed for them by Messrs. Dick, Kerr and Company, Limited. The Watch Committee has decided in favour of the suggestions of the Tramways Committee as to the rule of the footpath. The question of motors and other vehicles passing stationary and other cars has been referred to the chief constable.

### HULL.

WINTER CLOTHING FOR WOMEN CONDUCTORS.

The question of winter clothing for women conductors has been before the tramways committee. The manager stated that he had communicated with the women asking for their suggestions, and one depot had reported that they would like coats reaching to the knees, and that in place of skirts they preferred breeches fastened below the knees, with either leather leggings or puttees. "A very sensible suggestion," agreed a number of members.

### KEIGHLEY.

WOMEN EMPLOYEES.

Mr. H. Webber, borough electrical engineer and tramways manager of Keighley, has stated that the employment of women as conductresses has been extended during the year, and they have replaced all men conductors. The change, which was forced on the undertaking by the war, has proved very successful. He believes this to be also the opinion of the majority of the passengers. An experiment with women as drivers was tried in the early part of last winter, and Mr. Webber thinks it would have been successful if tried in the summer months. As the military authorities are now pressing all tramway undertakings to instal women drivers, it is probable that the experiment will be repeated, but Mr. Webber remarks that it would be most undesirable to have no men drivers whatever. It would be necessary to keep men on the trackless vehicles and one or two on the central tramways to give the necessary stability to the traffic department.

### LLANDUDNO.

CHARGES FOR ELECTRICITY SUPPLY.

At a meeting of Llandudno Council on July 20, the Electricity Committee reported that, after considering the subject of power for traction purposes, they recommended the Council seriously to consider the question of giving the Llandudno and Colwyn Electric Railway Company formal notice to terminate the existing agreement, with a view to entering into a fresh arrangement on terms that will be more equitable, having regard to the increased cost of production. The Council have supplied the power for the operation of the electric railway between Llandudno and Colwyn Bay since that line was opened, under the agreement which the committee proposed should be terminated. The price paid ranges from a penny a unit according to consumption. By a majority the proposal was referred back to the committee for further consideration, as it was associated with general questions as to the financial position of the electric supply undertaking.

### MANCHESTER.

METHODS OF DISHONEST PASSENGERS.

In a prosecution of a number of persons at Manchester for attempting to avoid payment of tramway fares and for riding in excess of the stages paid for, the Tramways Committee's solicitor stated that since the introduction of women conductors a practice seemed to be springing up of passengers keeping their fares in their hands without making any attempt to pay unless asked or an inspector boarded the car. Two of the defendants had travelled over four miles before inspectors discovered them without tickets. Fines of 20s. were inflicted in two cases and 10s. in others.

### NEWCASTLE-ON-TYNE.

EMPLOYEES' DEMANDS—COAL CARRIAGE BY SAND CARS.

At a meeting of the Newcastle Corporation Tramways Committee on July 6, Mr. Richard Mayne, chairman, presiding, a deputation was received from the Tramway Workers' Union in support of an application for further bonuses for employees, both men and women. The following bonuses were asked for:—Female conductors, 3s.; male conductors under 21, 5s.; female car cleaners, both day and night workers, 3s. The committee decided to refer the demand to the Committee of Production in London, on the understanding that the judgment of the Government authorities should be accepted as final by both parties. The Tramways Committee have agreed to a scheme submitted by Mr. E. Hatton, the general manager, for utilising the tramway sand-cars during next winter for the purpose of distributing coal to householders.

### NEWPORT.

NEW CARS FOR TRAMWAY EXTENSION.

At a recent meeting of the Town Council, Mr. J. Moxon, chairman of the Tramways and Electricity Committee, referring to the tramways extension, said that it was impossible to obtain new cars during the war. The London County Council had offered six top-covered double-deck cars with a seating capacity of sixty passengers, which were twelve years old, at £450 apiece, but unfortunately the cars could not pass under the bridges. It was stated that a new car of a similar type would to-day cost £1,200. The committee were given full powers to deal with the question.

### PLYMOUTH.

MILITARY DEMANDS ENTAIL DECREASE IN SERVICE.

Ald. S. H. Phillips, chairman of the Tramways Committee, has informed the Council that demands were being made by the military authorities which, if persisted in, would result in a large decrease of the number of cars at work. The military were calling up the only man the manager had to work the lathe. If he was taken the work to a large extent broke down. They also asked for seven drivers. That meant four cars being taken off. If they could not retain these men they must reduce the service, and then they would have more complaints from the public. The manager's report for June showed that the cars carried 437,000 more passengers, and earned £315 more than in the corresponding period of last year At the same time they were obliged to leave a large number of passengers behind.

### WALTHAMSTOW.

SUCCESS OF HALFPENNY FARE ABOLITION.

The Walthamstow Council Tramways were the first in Greater London to abolish halfpenny fares, and the success which followed the adoption of this course is noteworthy. The change first came into operation on April 3, 1916, so that the municipal year ended March 31 last covered practically twelve months' operation under the revised table of fares. The result shows an increase in revenue of £9,518; in average receipts per car-mile of 1·45d.; and a net balance after meeting all liabilities of £6,800, as against £918 for preceding year. This result should be encouraging to those other authorities in London which have more recently adopted a similar policy with regard to fares.

## PATENT LIST.

### Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

#### APPLICATIONS FOR LETTERS PATENT.

Electric signalling devices (9,108)—J. Atherton.
Fluid pressure brakes (9,168)—British Thomson-Houston Company (*General Electric Company*).
Apparatus for automatically stopping or retarding locomotives (9,121)—H. Foulkes and C. McNeal.
Trolley wheels for tramcars (9,256)—W. J. Hunter.
India-rubber tires for road vehicles (9,363)—C. Macintosh & Company.
Carburetter control mechanism for motor vehicles engines (9,091)—Standard Motor Company and R. W. Maudslay.
Control mechanism for electrical fittings of motor vehicles (9,092)—Standard Motor Company and R. W. Maudslay.
Mechanically-propelled vehicles (9,463)—J. Newall and E. Williams.
Motor car propulsion (9,355)—A. Richards.
Lifting jacks (9,079)—W. Robins.
Electro-pneumatic brake system (9,165)—W. V. Turner.
Trolley-heads of electric vehicles (9,146)—A. Wood.
Variable transmission mechanism for motor vehicles (9,735)—J. M. Armangué.
Attachment of rails to chairs and tie-bars and locking tie-bars in position (9,648)—H. Birkbeck (*Green*).
Means for securing railway rails in their chairs (9,679)—R. Bowen.
Automatic locking railway chair (9,767)—B. B. Roberts and J. Walters.
Change-speed gear of motor vehicles (9,792)—C. Stokes.
Brake gear of motor vehicles (9,793)—C. Stokes.
Continuous automatic fluid-pressure brakes (9,583)—J. C. Taite (*Bell*).
Lifting jacks for wheels of motor vehicles (9,770)—J. R. Watson.
Process and tool for the production of railway tires (10,070)—J. J. Baker, H. Brearley, and L. Jackson.
Self-acting brakes (9,951)—W. H. T. Beattie and R. C. Pessell.
Means for increasing leverage on brakes automatically (10,209)—G. S. Birtill and H. Mozley.
Tires and wheel rims for motor vehicles (9,874)—L. Brown and C. Macintosh and Company.
Lifting jacks (10,012)—M. Gilbey.
Railroads and tramways (10,120)—F. Palmer.
Railways, tramways, etc. (9,869)—P. F. Pogson.
Lifeguard for motor vehicles (10,143)—J. Stokes.
Fished joints of tramway and railway rails (10,231)—T. C. Way.
Transmission gear of motor vehicles (10,524)—W. Comery and the Raleigh Cycle Company.
Heavy traction attachment for motor vehicles (10,397)—H. Gibbs.
Device for guiding trolley pulley of electric car into contact with overhead wire (10,443)—E. B. Moyse.
Method of preventing tramcar trolley leaving overhead wires (10,389)—A. Richinson.
Traffic directing signals for road vehicles (10,315)—C. A. Singer.

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## Specifications Published.

1914.

Drainage plant for road beds containing tramway tracks (8,144)—Imrie. (*Deutsche Asphalt-Akt.-Ges. der Limmer und Vorwohler Grubenfelder.*)

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Variable speed driving gear (7,699—*106,665*)—R. C. Sayer.
Power transmission mechanisms for motor vehicles (7,978—*106,687*)—T. A. Tisdell and New Hudson Cycle Company.
Apparatus for registering the coasting and stoppage time of electric vehicles (10,622—*101,290*)—W. O. Wade and C. C. Chappelle.
Means for preventing shocks by the axles of tramway and railway vehicles (10,669—*106,718*)—T. C. Winfield.
Railway ties and sleepers (11,926—*106,731*)—P. V. Troupe.
Demountable unit power plants for motor vehicles (12,642—*106,737*)—F. Mueller.
Automobile electrical apparatus for welding (13,805—*106,752*)—Tilling-Stevens, Limited, and P. F. Smith.
Ventilating and cooling generators and motors in electric vehicles (13,874—*106,754*)—Tilling-Stevens, Limited, and P. F. Smith.
Speed changing, reversing, and braking gearing (14,117—*106,757*)—G. Pollard and Menco-Elma Syndicate.
Back axle reduction gear for motor vehicles (17,686—*106,783*)—F. H. Royce and Rolls-Royce, Limited.
Automatic train signal and stop (3,530—*100,353*)—National Safety Appliance Company.
Method of treating rails, switches, points, crossings, etc. (14,110—*106,928*)—C. P. Sandberg.
Electro-pneumatic brakes for railway vehicles (18,374—*106,813*)—E. H. Dewson.
Indicating stations or stopping points on tramways (5,213—*107,024*)—C. W. Mallins.
Motor vehicles (8,895—*107,080*)—C. H. Crawley, M. E. Starkey, and W. E. Clarke.
Speed-changing mechanism of motor vehicles (10,189—*107,102*)—J. D. Dean, F. A. Howorth, and H. A. Jardine.
Back axles for motor vehicles (15,224—*107,149*)—Albion Motor Car Company and T. B. Murray.
Apparatus for the lighting and heating of motor road vehicles, trains, etc. (9,203—*107,260*)—W. F. W. Rhodes and J. Firth.
Direction indicators for motor vehicles (10,281—*107,279*)—H. S. Neville, W. E. Trinder, and H. G. Osborne.
Driving mechanism for motor vehicles (13,595—*107,313*)—C. H. Blomstrom.
Compound engines for motor vehicles (17,689—*107,339*)—W. T. Bell and L. W. Jones.

1917.

Means for converting a motor pleasure vehicle chassis into a commercial truck chassis (5,468—*105,762*)—W. F. Hudson.

## Colonial and Foreign Tramways Traffic Returns.

| NAME OF COMPANY. | 1916. WEEKS ENDED. July 1. | July 8. | July 15. | July 22. | July 29. | 1917. WEEKS ENDED. June 30. | July 7. | July 14. | July 21. | July 28. | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | | £ | £ | £ | £ | | | £ | £ |
| Anglo-Argentine ... ... ... | 46.726 | 51.679 | 54.578 | 49.729 | 46.346 | 49.639 | 50.782 | 52.007 | 48.949 | 46.664 | 30 | 1.535.461 | + 7.070 |
| Calcutta ... ... ... Rs. | 66.388 | 70.941 | 70.546 | 69.354 | 66.895 | 65.382 | 67.558 | 68.719 | 71.217 | 70.584 | 30 | 2.028.510 | + 20.182 |
| Madras ... ... ... Rs. | 29.250 | (14 days) | 34.007 | (14 days) | ... | 32.492 | (14 days) | 36.083 | (14 days) | ... | 28 | 444.499 | + 40.150 |
| Pernambuco ... ... ... ... | 2.821 | 3.104 | 4.066 | 2.998 | 2.917 | 3.694 | 4.201 | 4.086 | 4.003 | 3.892 | 30 | 110.937 | + 21.829 |

## Companies Issuing Monthly Statements.

| | 1916. Feb. | March. | April. | May. | June. | July. | 1917. Feb. | March. | April. | May. | June. | July. | Wks. | AGGREGATE. 1916-17. | + or −. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Ballarat & Bendigo .. | 3.512 | 3.881 | 3.727 | 3.854 | ... | ... | 3.196 | 3.422 | 4.611 | 2.991 | ... | ... | 8 | 7.602 | + 21 |
| Brazilian Traction Mlrs | 6276000 | 6913000 | 6882000 | 7304000 | 7178000 | ... | 6872000 | 7549000 | 7453000 | 7864000 | 7642000 | ... | 26 | 44.646.000 | +3.467.000 |
| Brisbane ... ... | 30.320 | 34.275 | 32.575 | 33.150 | 31.390 | 32,880 | 29.800 | 33.340 | 31.620 | 33.340 | 32.475 | 32.720 | 30 | 226.315 | − 915 |
| British Columbia $ | 572.935 | 446.401 | 421.265 | 414.215 | 400.814 | ... | 581.555 | 456.626 | 447.429 | 438.919 | 373,029 | ... | 52 | 5.325.756 | + 262.642 |
| Buenos Ayres Lacroze | 39.137 | 42.219 | 40.220 | 40.220 | 36.213 | 38,439 | 35.977 | 41.337 | 39.111 | 40.595 | 38.020 | 38,063 | 4 | 38.063 | − 376 |
| Burma ... ... | 20.345 | 22.958 | 22.191 | 23.585 | 24.027 | ... | 22.912 | 27.132 | 23.660 | 24.906 | 25,463 | ... | 48 | 282.879 | + 29.134 |
| Cape Town ... ... | ... | 14.994 | ... | ... | ... | ... | 16.229 | 17.688 | 16.705 | 15.867 | ... | ... | 21 | 84.829 | — |
| Carthagena & Herrerias | 1.585 | 2.991 | 2.513 | 2.927 | 3.512 | 2.371 | 3.223 | 2.955 | 4.366 | 4.321 | 5.325 | 5.763 | 30 | 29.935 | + 11.195 |
| Cordoba ... ... | 11.831 | 13.598 | ... | 14.869 | ... | ... | 11.898 | 13.098 | ... | 13.735 | ... | ... | 9 | 27.395 | − 1.546 |
| East India ... ... | 1.863 | 2.196 | 2.116 | 2.161 | 2.283 | 2,220 | 1.570 | 1.647 | 1.445 | 1.455 | 1.186 | 1,183 | 52 | 21.509 | − 3.861 |
| Kalgoorlie ... ... | 2.248 | 2.479 | 2.553 | ... | ... | ... | 2.193 | 2.772 | 2.705 | ... | ... | ... | 17 | 10.101 | + 585 |
| La Plata ... ... | 4.345 | 4.611 | 4.354 | 4.342 | 3.735 | 3.910 | 4.092 | 4.527 | 4.229 | 4.126 | 3.852 | 3.875 | 30 | 29.019 | − 816 |
| Lima ... ... ... | ... | 34.169 | 33.542 | 33.966 | ... | ... | ... | 37.569 | 37.807 | 35.321 | ... | ... | 21 | 181.809 | + 13.098 |
| Manaos ... Rs. | ... | ... | 155.030 | 152.854 | 144.913 | 152.380 | 144.532 | 161.156 | 160.545 | 159,613 | ... | ... | — | — | — |
| Manila ... ... $ | 66.303 | ... | ... | 53.900 | ... | ... | 73.200 | ... | ... | 61,500 | ... | ... | — | — | — |
| Mexico ... $ | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Monte Video ... ... | 32.502 | 31.956 | 28.997 | 28.349 | 25.300 | ... | 32.304 | 31.979 | 29.230 | 28.716 | 27.458 | ... | 35 | 242.796 | + 1.728 |
| Peruvian ... $ | 775.700 | ... | ... | 826.900 | 929.500 | 835,430 | 844.770 | ... | ... | 902.780 | 965.420 | 975,000 | 4 | 975.000 | + 139.570 |
| Port Elizabeth ... | 3,857 | ... | ... | ... | ... | ... | 3,553 | 4,428 | 3,904 | 3.494 | ... | ... | 21 | 19.877 | — |
| Rangoon ... ... | 4.674 | 5.501 | 4.849 | 4.589 | 4.205 | 4,357 | 4.605 | 6,226 | 5.036 | 4.737 | 4.383 | 4,783 | 30 | 34.403 | + 1.465 |
| Toronto ... $ | 846,256 | 910.969 | 883.209 | 903.924 | 884.491 | ... | 932.567 | ... | 970.367 | 992.460 | 984.529 | ... | 26 | 5.873.584 | + 538,385 |
| Winnipeg ... $ | 293,250 | 296.500 | 282,498 | 276,980 | 254,686 | ... | 280.717 | 293.094 | 265,594 | 259,794 | 254,226 | ... | 26 | 1.673,370 | − 28.104 |

(*Continued on page 116*)



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# TRAFFIC RETURNS—*continued.*

## Tramways and Omnibus Undertakings in the United Kingdom.

| NAME OF COMPANY OR CORPORATION. | 1916. WEEKS ENDED. July 1. | July 8. | July 15. | July 22. | July 29. | 1917. WEEKS ENDED. June 30. | July 7. | July 14. | July 21. | July 28. | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | | £ | £ | £ | £ | | | £ | £ |
| Aberdare U.D. Council | 353 | 364 | 384 | 389 | 410 | 394 | 415 | 462 | 450 | 484 | 16 | 7.044 | + 722 |
| Aberdeen Corporation | 1.834 | 1.908 | 1.841 | 1.865 | 2.267 | 2.230 | 2.293 | 2.144 | 2 535 | 2 319 | 8 | 17.967 | + 2 772 |
| Accrington Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Ayr Corporation | 385 | 470 | 503 | 745 | 710 | 524 | 595 | 724 | 1 382 | 823 | 11 | 6.394 | + 1.327 |
| Bath Electric | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Belfast City | 5.804 | 5.580 | 5.624 | 5.482 | 5.941 | 6.429 | 6.558 | 7.183 | 5.784 | 6.173 | 17 | 104.136 | + 8.794 |
| Birkenhead Corporation | 1.567 | 1.612 | 1.531 | 1.621 | 1.673 | 1.903 | 1.955 | 1.909 | 1 930 | 1.955 | 17½ | 30.548 | + 4 217 |
| Birmingham Corporation | 16 322 | 16 292 | 16 617 | 16.521 | 17.152 | 17.511 | 18 833 | 18 033 | 18.176 | 18 840 | 17 | 302.373 | - 20 865 |
| Birmingham Corp. Motor Omnibuses | 970 | 975 | 1.028 | 1.050 | 1.173 | 896 | 1 053 | 1 001 | 990 | 1.069 | 17 | 15.540 | + 887 |
| Blackburn Corporation | 1.263 | 1.207 | 1.194 | 1.300 | 1.649 | 1 364 | 1.616 | 1.592 | 1.656 | 1.676 | 17½ | 26 144 | - 3 599 |
| Blackpool and Fleetwood | 892 | 1.583 | 1.233 | 1 526 | 1.822 | 986 | 1 773 | 1 559 | 1 487 | 1.692 | 29 | 19 361 | - 226 |
| Blackpool Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Bolton Corporation | 2.917 | 2.914 | 2.788 | 3.095 | 3.083 | 3.377 | 4.065 | 3.363 | 3.423 | 3 391 | 17 | 56.558 | + 6 036 |
| Bournemouth Corporation | 2.304 | 2.179 | 2.411 | 2.516 | 2 775 | 2.403 | 2 479 | 2.612 | 2 863 | 2 620 | 17½ | 41 510 | - 1 045 |
| Bradford Corporation | 6.551 | 6 859 | 6.657 | 7.060 | 7.679 | 7.817 | 8.098 | 7.995 | 8 067 | 8.256 | 17 | 129.978 | + 12 322 |
| Brighton Corporation | 1.236 | 1.328 | 1.273 | 1.451 | 1.542 | 1 419 | 1.523 | 1 657 | 1 714 | 1.787 | 17½ | 24 183 | + 3 298 |
| Bristol | 4.916 | 5.076 | 5 181 | 5 182 | 5.574 | 5 472 | 6.118 | 5 650 | 5.999 | 6 172 | 29 | 155.146 | + 12 416 |
| Burnley Corporation | 1.601 | 1 665 | 1 586 | 1 626 | 1.798 | 1.796 | 1 981 | 1.714 | 250 | 1.285 | | — | — |
| Burton-on-Trent Corporation | 270 | 286 | 266 | 285 | 291 | 298 | 306 | 306 | 374 | 322 | 17 | 4.978 | - 401 |
| Bury Corporation | 1.344 | 1.505 | 1 383 | 1 581 | 1.555 | 1.698 | 1.982 | 1 697 | 1.765 | 1.763 | 17½ | 28 733 | 3 208 |
| Cardiff Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Chatham and District | 1.317 | 1.341 | 1 343 | 1 336 | 1.396 | 1.396 | 1.416 | 1.370 | 1 518 | 1.547 | 30 | 37.472 | - 2.525 |
| Chesterfield Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Colne Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Cork Electric | 567 | 581 | 542 | 589 | 619 | 634 | 671 | 637 | 647 | 680 | 30 | 15.744 | - 997 |
| Croydon Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Derby Corporation | 1.114 | 1.119 | 1.138 | 1.162 | 1.255 | 1.168 | 1.226 | 1.218 | 1.258 | 1.290 | 17 | 19.957 | + 469 |
| Dover Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Dublin and Lucan | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Dublin United | 7.274 | 6.464 | 6.629 | 7.034 | 7.629 | 7.528 | 8.130 | 7.207 | 7.547 | 7.723 | 30 | 194.584 | + 22.120 |
| Dundee City | 1.378 | 1.359 | 1.340 | 1.409 | 1.480 | 1.530 | 1.557 | 1.529 | 1.658 | 1.937 | 10½ | 15.963 | + 1.762 |
| East Ham Corporation | 1.388 | 1 398 | 1.349 | 1 337 | 1 399 | 1 422 | 1 452 | 1 340 | 1.436 | 1.490 | 17 | 24.318 | - 1.723 |
| Exeter Corporation | 389 | 405 | 403 | 438 | 466 | 392 | 435 | 435 | 450 | 464 | 17 | 6 703 | - 69 |
| Gearless Motor 'Buses | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Glasgow Corporation | 23.065 | 22.157 | 22 493 | 22 251 | 23 153 | 27.448 | 27.144 | 26.831 | 21.692 | 24.041 | 8½ | 218.728 | + 26 190 |
| Glossop (Urban Elec. Supply Co.) | 134 | 139 | 136 | 144 | 161 | 152 | 172 | 169 | 158 | 174 | 30 | 4 300 | + 256 |
| Halifax Corporation | 2.234 | 2.275 | 2.226 | 2.180 | 2.630 | 2.455 | 2.689 | 2.662 | 2 640 | 2.669 | 16½ | 40 365 | + 2.941 |
| Halifax Corp. Motor Omnibuses | 50 | 49 | 48 | 47 | 55 | 43 | 47 | 46 | 51 | 54 | 16½ | 728 | - 52 |
| Hastings and District | 1.042 | 1.131 | 1.156 | 1.266 | 1.321 | 1.324 | 1.352 | 1.487 | 1.516 | 1.599 | 30 | 32.864 | - 5.641 |
| Huddersfield Corporation | 2.833 | 2.974 | 2 893 | 2 963 | 3.380 | 3.223 | 3 536 | 3 399 | 3 330 | 3 609 | 17 | 55 528 | - 4.759 |
| Hull Corporation | 3.184 | 3.234 | 3 279 | 3 288 | 3 238 | 3 319 | 3 460 | 3 402 | 3 512 | 3 607 | 17 | 56 806 | - 3 037 |
| Ilford U.D. Council | 746 | 718 | 713 | 723 | 741 | 775 | 809 | 752 | 797 | 837 | 17 | 12 948 | - 1.073 |
| Ilkeston Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Ipswich Corporation | 625 | 677 | 621 | 554 | 567 | 698 | 731 | 682 | 779 | 851 | 17 | 11 049 | + 1.695 |
| Isle of Thanet | 384 | 446 | 453 | 525 | 573 | 386 | 377 | 363 | 376 | 422 | 43 | 12.242 | - 609 |
| Kilmarnock Corporation | 169 | 176 | 167 | 187 | 228 | 183 | 215 | 196 | 227 | 246 | 10½ | 2.076 | - 185 |
| Lanarkshire | 2.372 | 2.371 | 2.255 | 2.478 | 2.675 | 2.929 | 3.139 | 2.902 | 3.908 | 3.096 | 30 | 79.915 | - 12.795 |
| Lancashire United | 1.851 | 2.054 | 1.844 | 1.810 | 2.163 | 2 316 | 3.331 | 3.170 | 2.512 | 2 765 | 30 | 64 897 | - 12 879 |
| Leeds City | 9 764 | 10.074 | 10 006 | 10.110 | 10.905 | 10.958 | 11 835 | 11.506 | 11.256 | 11.763 | 17 | 187 223 | - 20 366 |
| Leicester Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Leith Corporation | 850 | 852 | 913 | 951 | 1.043 | 1.070 | 1.102 | 1.125 | 1.299 | 1.318 | 10½ | 11.734 | 2 304 |
| Leyton U.D. Council | 1.753 | 1.738 | 1.762 | 1.706 | 1.828 | 1.816 | 1 934 | 1.848 | 1.934 | 2.000 | 17 | 32 435 | + 4.058 |
| Liverpool Corporation | 14 478 | 14.866 | 14 690 | 14.643 | 15.665 | 16.122 | 17 375 | 17 143 | 16 589 | 17 251 | 29½ | 451 516 | - 38 744 |
| Llandudno and Colwyn Bay | 427 | 448 | 492 | 554 | 580 | 401 | 433 | 475 | 524 | 561 | 34½ | 9.239 | - 699 |
| London County Council | 49.001 | 49.616 | 49 514 | 48 584 | 50.556 | 55.162 | 56.630 | 55.088 | 56.543 | 58 169 | 16½ | 904 954 | - 106.663 |
| London General Omnibus | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| London United | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Lowestoft Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Maidstone Corporation | 210 | 246 | 222 | 214 | 226 | 239 | 272 | 251 | 263 | 264 | 17 | 4.039 | 354 |
| Manchester Corporation | 20.674 | 19 320 | 19.055 | 19.355 | 20 411 | 19 280 | 20.234 | 20.845 | 20.510 | 21 308 | 17 | 346 680 | 23 476 |
| Metropolitan Electric Tramways | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| National Steam Car | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Nelson Corporation | ... | ... | 200 | 230 | 257 | ... | ... | 271 | 219 | 289 | 17 | 3.990 | - 246 |
| Newcastle-on-Tyne Corporation | 6 753 | 6.992 | 7.129 | 7.125 | 7.370 | 8.158 | 7.644 | 7.738 | 8.005 | 8.216 | 17 | 130 379 | - 19 159 |
| Newport (Mon.) Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| New St. Helens and District | 1 039 | 1.081 | 1.083 | 1.030 | 1 289 | 1.330 | 2 017 | 1.778 | 1.506 | 1 474 | 4 | 5.875 | + 1.772 |
| Northampton Corporation | 701 | 716 | 695 | 691 | 738 | 805 | 834 | 819 | 852 | 861 | 17 | 13.535 | + 1 663 |
| Nottingham Corporation | 3.907 | 3.852 | 3.993 | 3.888 | 4.150 | 4.197 | 4.500 | 4.485 | 4.483 | 4.631 | 17 | 71 662 | + 6.401 |
| Oldham Corporation | 2 400 | 2.460 | 2.462 | 2.806 | 2.702 | 2.895 | 2.922 | 2.955 | 3.038 | 2.888 | 18 | 50.970 | + 4 861 |
| Portsmouth Corporation | 2 754 | 3.042 | 2.886 | 3.019 | 3.319 | 2.925 | 3.429 | 3.195 | 3.285 | 3.530 | | — | — |
| Preston Corporation | 1.042 | 1.091 | 1.126 | 1.029 | 1.132 | 1.166 | 1.215 | 1 184 | 1.196 | 1.256 | 16½ | 19.529 | + 1 307 |
| Provincial | 2.464 | 2.684 | 2 633 | 2 698 | 2 913 | 2 483 | 2.808 | 2.757 | 2.755 | 3 050 | 43 | 94 824 | - 558 |
| Reading Corporation | 836 | 847 | 875 | 844 | 903 | 987 | 1 064 | 1.033 | 1 076 | 1.108 | 16½ | 16.752 | + 2.822 |
| Rhondda Tramways | 1.294 | 1.304 | 1.351 | 1.338 | 1.424 | 1.501 | 1.624 | 1.539 | 1 564 | 1.608 | 30 | 43.037 | + 6 129 |
| Rochdale Corporation | 1.647 | 1.811 | 1.785 | 1.915 | 2.085 | 2.055 | 2.338 | 2 251 | 2.193 | 2.292 | 17 | 35.909 | + 4 299 |
| Rotherham Corporation | 1.571 | 1 532 | 1.548 | 1 647 | 1 660 | 1 774 | 1.802 | 1.826 | 1 858 | 1.764 | 17½ | 30 772 | + 4.768 |
| Salford Corporation | 5 654 | 5 759 | 5.468 | 6 140 | 5.973 | 6.983 | 7 038 | 6.637 | 6.954 | 6.589 | 17½ | 113 008 | + 16 398 |
| Sheffield Corporation | 10.742 | 10 828 | 10.679 | 10.990 | 10.992 | 11.861 | 12.211 | 12.161 | 12.505 | 12.150 | 18 | 211 427 | + 23 323 |
| Southampton Corporation | 1 679 | 1 716 | 1.657 | 1.710 | 1 838 | 1.976 | 2.049 | 2 079 | 2 101 | 2.179 | 16½ | 31.995 | - 4.947 |
| Southend-on-Sea Corporation | 895 | 960 | 1 010 | 1 019 | 1 155 | 984 | 1 057 | 1 012 | 1 111 | 1 213 | 17 | 15 787 | + 1 117 |
| South Metropolitan Tramways | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| South Shields Corporation | 810 | 849 | 896 | 905 | 992 | 1.172 | 951 | 964 | 985 | 1.060 | 17 | 15.982 | + 2 095 |
| Sunderland Corporation | 1.614 | 1.645 | 1 708 | 1 834 | 1.985 | 1 914 | 1.783 | 1 818 | 1 939 | 2 033 | 17 | 30.443 | - 2 527 |
| Sunderland District | 629 | 592 | 601 | 647 | 780 | 800 | 809 | 737 | 772 | 942 | 39 | 26.586 | - 3 680 |
| Swindon Corporation | 198 | 193 | ... | ... | ... | 258 | 271 | ... | ... | ... | | — | — |
| Torquay Tramways | 593 | 623 | 594 | 690 | 760 | 671 | 704 | 736 | 715 | 802 | 30 | 15.726 | + 1.300 |
| Tramways (M.E.T.) Omnibus Co. | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Tyneside Tramways and Tramroads | 667 | 629 | 633 | 702 | 846 | 1.035 | 1.145 | 1.233 | 1.005 | 1.077 | 4 | 3.585 | + 872 |
| Wallasey Corporation | 1 388 | 1 471 | 1.438 | 1 539 | 1.779 | 1 587 | 1 829 | 1.932 | 1 839 | 2.059 | 17½ | 26.663 | + 2.917 |
| Walsall Corporation | 827 | 827 | 824 | 834 | 859 | 911 | 976 | 947 | 973 | 984 | 16 | 15.926 | + 1.612 |
| Walthamstow U.D. Council | 1.120 | 1 158 | 1.148 | 1.146 | 1.274 | 1.220 | 1.354 | 1 229 | 1 284 | 1 421 | 17 | 21 515 | + 2 845 |
| Warrington Corporation | 491 | 497 | 495 | 476 | 516 | ... | ... | 538 | 526 | 552 | 17 | 8.726 | + 586 |
| West Ham Corporation | 3 304 | 3 322 | 3.346 | 3.259 | 3.386 | 3.647 | 3 732 | 3.676 | 3.733 | 3 792 | 16½ | 62 090 | + 6 809 |
| Wigan Corporation | ... | ... | 1 669 | 1.677 | 1.769 | ... | ... | 2 034 | 1 963 | 2.043 | 17 | 32 376 | - 3.984 |
| Wolverhampton Corporation | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | | — | — |
| Yorkshire (West Riding) | 1.870 | 1.783 | 1.710 | 1.831 | 1.980 | 2.141 | 2.326 | 2 196 | 2 250 | 2 332 | 30 | 60.764 | 9 639 |

### * TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

### TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.


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# Averages Tell Results

## *Sheffield Corporation's Records of Mileage and Maintenance*

THERE is nothing so certain or so deadly in the world of business and commercial endeavour as the law of average. For instance, the life of any one particular person is the most problematical thing in the world: the life of half-a-million is the one safe estimate upon which insurance can be based.

SO when it comes to commercial motors the performance of any one particular vehicle may be totally unreliable—the performance of a dozen or twenty is evidence which will bear sifting and pay for studying. 10,000 miles may be regarded as only a promise; 500,000 miles is a performance.

HERE are the figures for the past four years of the Sheffield Corporation Omnibus Service. A fleet of 21 Daimler Vehicles is now employed.

Per Bus Mile.

| Year ending 25th March. | Mileage Run. | Average Cost. | Average Revenue. | Repairs and Maintenance. |
|---|---|---|---|---|
| 1914 | 214,775 | 6·67d. | 10·20d. | 1·22d. |
| 1915 | 369,404 | 7·03d. | 10·47d. | 1·91d. |
| 1916 | 540,628 | 8·48d. | 12·06d. | 2·87d. |
| 1917 | 620,196 | 9·84d. | 13·31d. | 3·27d. |

IF you are a user of Commercial Motor Vehicles you cannot afford to neglect the law of average. It calls for reliable, adequate, and immediate records of your vehicles' performances. The Daimler Record System is at the Service of all users and prospective users; by its adoption all the information you require can be formulated, and comparisons will prove that

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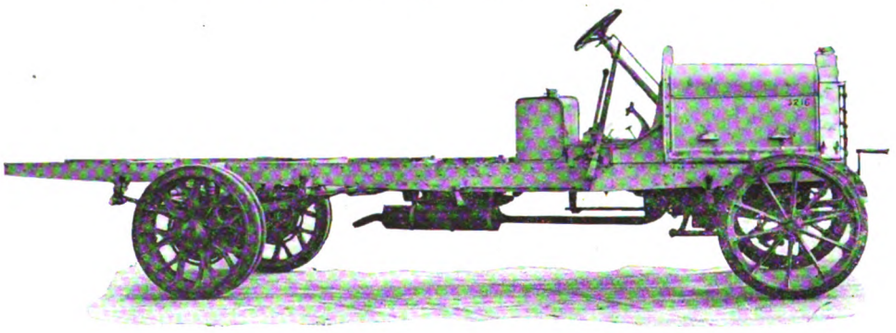
**The Daimler Company, Ltd., Coventry**



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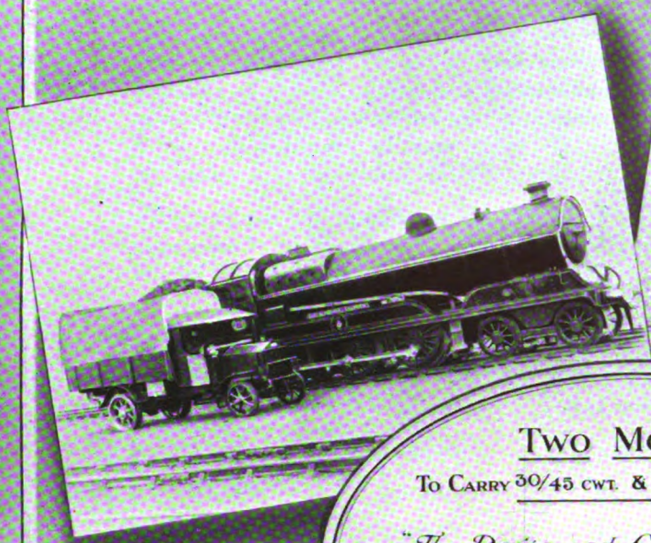
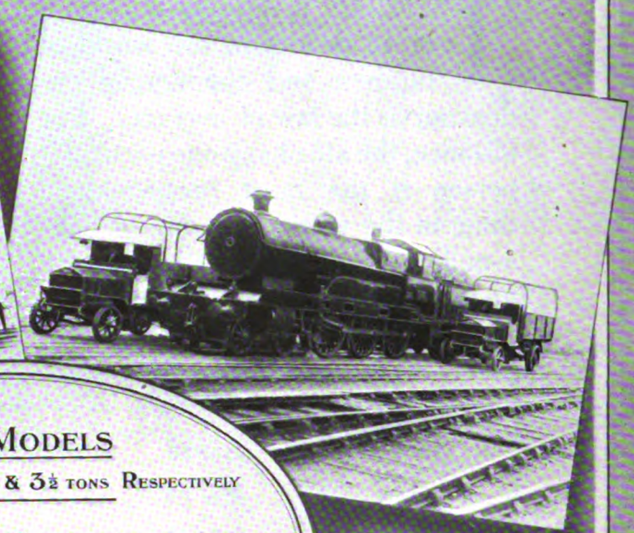
# NAPIER

## MOTOR VEHICLES.





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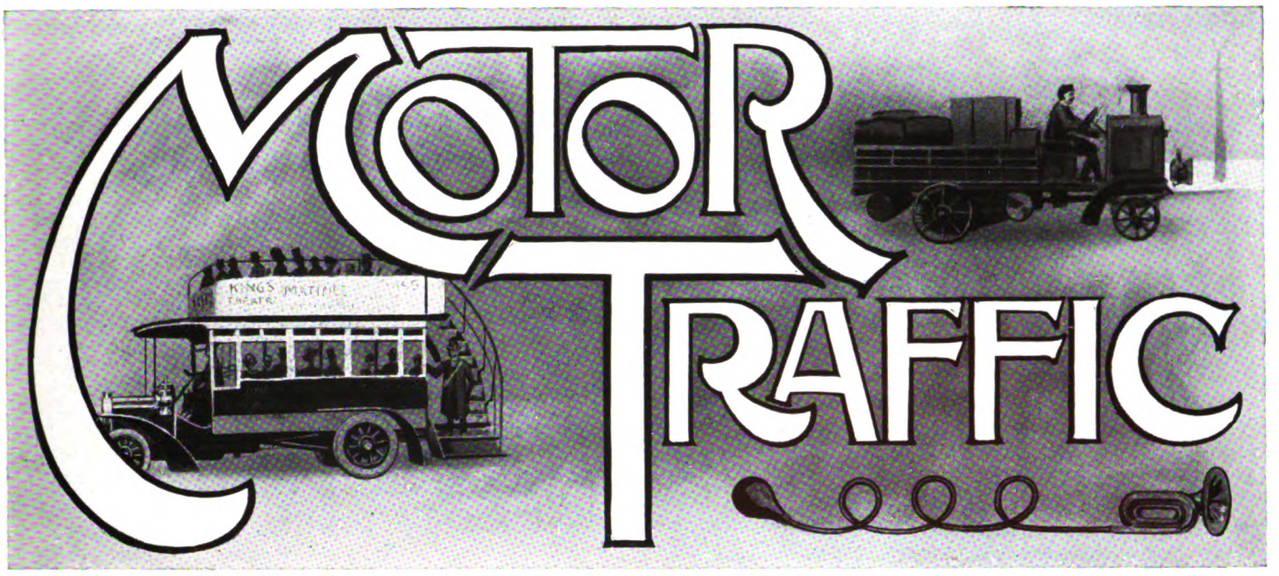


Whatever may be the need for drivers of trade vehicles, it is evident that experienced motor users do not consider it safe to reduce the age at which a licence for driving a public service vehicle can be granted. This is no doubt a wise precaution, but it might be qualified to some slight extent. If the minimum age limit for the drivers of motor vans were reduced by a year, it might not prove unsatisfactory to reduce the age limit for drivers of public service vehicles by six months, and to grant the licence only to applicants who can show a record of at least six months' satisfactory handling of a van or lorry. It is, of course, more important to ensure a proper degree of responsibility on the part of a driver if he is directly in charge of the lives of others. At the same time, the safety of all forms of traffic is interdependent. If goods vehicles are handled by youths of a reckless or irresponsible disposition, they are almost as likely to cause accidents to motor omnibuses as to themselves. No driver, however good, is safe while passing through traffic incompetently handled.

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On the general question of the suitability of youthful drivers there is at least one argument which ought to be placed on the credit side. A boy of sixteen or seventeen years of age may be disposed to take risks, but he may at least be expected to have strong nerves and a very high degree of confidence in himself. The quality that is needed to avoid an accident in face of some sudden emergency is that of rapid decision not interfered with by nerve failure or hesitation due to any cause. The boy may take his risk and justify himself by results, while the older man, having, through the same lack of experience, got himself into the same tight corner, may, by having a clearer realisation of his danger, render himself all the more incompetent to deal with it. If it came to the question of employing either a boy of sixteen or a man who, let us say, has been invalided out of the army owing to nerve failure or shell shock, we should probably be better advised to trust ourselves to the former. Under present regulations, however, he would be refused a licence, which would be freely granted to the older man.

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The decision of the Local Government Board to relax for the time being the regulations as regards the shape of the steel tires of tractors used upon the road is avowedly only an emergency provision. The idea is to make it possible to employ upon the road agricultural motor tractors, the wheels of which are fitted with strakes not in exact accordance with the former law, but not such as to do any very serious damage to the roads, assuming the tractor weight and also the weight hauled to be moderate. It is questionable whether this temporary relaxation is really necessary in the interests of the efficiency of farm tractors. Hitherto British manufacturers of these machines have been obliged to adhere to the letter of the law. Even if a tractor is not used for road haulage, it must at times travel upon the road to go to its work. The regulation strakes on driving wheels have been found satisfactory enough for the purpose of getting a grip on hard, dry land, but when the surface of the land is greasy, spuds or spikes must of necessity be fitted, and these, if they are to be effective in the fields, must be altogether outside the pale when the machine is on the road. Just at present, of course, we are obliged to make up the deficiency in our own agricultural machinery by importing freely. The tractors brought over from America have not had their wheels designed to comply with our laws, and if it were necessary to fit new wheels before using them, serious delays would be caused, and the number of machines that could be made available for service would be greatly reduced. Thus, the temporary privilege conferred by the Local Government Board Order is temporarily essential. It is to be hoped, however, that we shall go back to the old rules as regards the strakes on wheels at the first opportunity. Permanent change in the regulations affecting the steering wheels of farm tractors would be more welcome. These, to get a grip on soft land, are generally fitted with what amounts to a narrow projecting ring round the centre of the circumference of the tire. This really makes the wheel illegal for road use, but provided that the weight upon the wheel is only small, it would seem possible to offer a permanent concession in respect of machines that have been constructed primarily for work in the fields. In these matters we have to consider the interests of the general public and of the road authorities as well as those of the motor owner, and it is therefore unwise and unreasonable to ask too much. We may suggest, however, that this small concession would do nobody any harm.

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Whatever may be done in the matter of rendering legal various forms of wheel particularly desirable on field tractors, we must all the while bear in mind that no machine deserves much consideration, unless the diameter of the wheels fitted is decidedly generous. The big wheel is better for the road and better for the



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mechanism. It is also better on the land. It may cost a little more, but it is well worth it. We cannot make up for lack of diameter by increasing the width of the tire. This may prevent the wheel from sinking in too far on soft ground, but is of very little effect on a hard road of pronounced camber. Moreover, on all surfaces the small wheel is wasteful of power, because the temporary or permanent depression which it forms beneath it has steep sides up which the power of the machine must push the wheel. The depression made by a large wheel, on the other hand, has quite a gentle declivity. If we could make a wheel of infinite diameter it would get so big a bearing surface that it would not sink in at all, and though this is impossible we can approximate to the ideal by replacing the wheel by a chain track, which forms in effect a small segment of a very large wheel, and allows of heavy weights being carried without appreciable compression of the soil or road. This matter of large wheels is one that has been discussed from time to time for many years. It is again brought into prominence by the arrival of the agricultural tractor, and the need of protecting the roads from the damage that might result from the free use of machines of any design that the farmer happens to fancy. We need have no hesitation in our advocacy, for the simple reason that what is good for the road is as a matter of fact good for the motor user, and if he will not select it of his own free will, there is every reason for forcing it upon him.

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Before the war the military authorities were criticised for stipulating that vehicles of subvention model should have wheels of unusually large diameter. It was urged that the result was to raise the platform so high as to be inconvenient for loading. If so, the existing loading facilities must be altered rather than that we should go back to the small wheel on the lorry. Steam vehicles, having been less used for military purposes, are sometimes rather bad offenders in the matter of small wheels, and it is noticeable that many of the electric vans and lorries which have been helped into prominence partly by their real merits and partly by the shortage of petrol, err on the small side. Incidentally, these vehicles are rather heavy, owing to the necessity for carrying weighty batteries, so that in their case a fault of this kind is all the more objectionable. The Commissioner of Police, in urging that the weight of London omnibuses should be still further reduced, is endeavouring to consult the interests of the public and of those who live along omnibus routes. He would probably be better advised if he were to stipulate larger wheels and make a small additional allowance in respect of weight to cover the increased weight of the big wheels and correspondingly big tires. It is not weight in itself which is responsible for vibration and road damage, but rather the comparative inadequacy of the means provided for carrying that weight.

Motorists' Work After the War.—At the annual meeting of the Automobile Association and Motor Union, the chairman (Mr. W. Joynson Hicks, M.P.) said that a great deal of work would have to be done after the war. The most important work would be in connection with the restoration and repair of British roads. In comparison with pre-war periods the road materials used for repairs in one county alone were now reduced to less than one-half, and he urged that it was essential that the roads should not only be restored, but greatly improved, after the war was ended. They must also assist in the revival of the manufacture of motor vehicles. After the war there would be new motor engines and cars far more wonderful than those in use before the war.

## COAL GAS AS A MOTOR FUEL.

While confirming our own opinion that coal gas cannot fail to prove a useful substitute in emergency for petrol in connection with certain services, the vehicles employed upon which adapt themselves fairly well to the carriage of large gas containers, the report of the executive committee of the British Commercial Gas Association just published does not give the impression of great optimism as to the future of coal gas fuel viewed as a whole. This future obviously depends very much on the possibility of carrying fuel in some more compressed form than that in which it is at present employed. The Gas Association do not consider it desirable to attempt to use the highest possible pressures, on account of the high cost of compression, the subsequent supervision necessary, the depreciation of the containers, and the loss of efficiency of the gas. They recommend moderate pressures of about 300 to 400 lb. per square inch, or, say, 20 to 25 atmospheres. Compression at 25 atmospheres would reduce the space occupied by a thousand cubic feet of gas to 40 cubic feet. The Association considers that from 250 to 300 cubic feet of gas gives an equivalent mileage to one gallon of petrol, though it should be mentioned incidentally that the results of experience seem to show that the actual engine power developed is about 15 per cent. lower with coal gas than with petrol. Taking 250 cubic feet as the equivalent of a gallon, the containers necessary to carry the equivalent of four gallons would therefore have to have a total capacity of 40 cubic feet. They would, in fact, be large, unwieldy, and heavy. It is pointed out that the whole supply need not be carried in one container, but the various vessels could be connected by solid drawn copper tube weighing only about 4½ lb. per 10 ft. run. A table of figures is given showing the weights of existing containers. From this it appears that for a pressure of 25 atmospheres a container with a volume of 20 cubic feet weighs rather over 750 lb. Two such containers would therefore weigh approximately 14 cwt. It is suggested that the recent discovery of steels of immense tensile strength will permit of some considerable reduction of weight, amounting possibly to 50 per cent. Even so, to take an example, a 30 cwt. van carrying enough fuel for a run of about 50 miles would apparently have its useful load capacity reduced to about 23 cwt. In some services this would not matter very much; in others it would be a vital disadvantage. In any case, the carriage of so much dead weight would increase the cost of operation, and largely neutralise the saving in fuel cost.

As regards this last point, we may perhaps assume that after the war the average price of gas will be approximately 2s. 6d. per thousand cubic feet. This would mean that this type of fuel would be available under the present system, in which it is stored approximately at atmospheric pressure, at a cost corresponding to 7½d. per gallon of petrol. It is admitted that if compressed gas had to be supplied, the cost would be higher. We should have to take into account the considerable first cost of the reservoirs. Also, the cost of the compressing machinery and the expense involved by utilising power to operate that machinery. Probably the compressed gas would be not less than double as expensive as the same quantity of gas at atmospheric pressure. On this assumption it would correspond to petrol or benzol at about 1s. 3d. a gallon, with the additional handicap of materially reducing the useful load capacity of the vehicle, and involving constant expenditure under various headings in the carriage of useless load. For instance, part of what we might save on fuel would be lost in additional tire wear. On the whole, then, it does not appear that the possibilities of using compressed gas are particularly promising.

The other system, which is already in employment, is obviously not universally applicable, owing to the immense size of the containers necessary as well as their fragile nature. These containers have the advantage of being fairly cheap and not very weighty. Consequently it is at least possible that certain regular local services carried on by vehicles of the single-decked omnibus type may continue to use coal gas fuel permanently. In other spheres there may be a limited number of instances of its regular use, but these will be almost certainly much in the minority. In fine, the report seems to indicate once and for all that while coal gas fuel may be a great blessing to many people at the moment, it cannot be regarded as in any sense a generally applicable alternative to the liquid fuels with which we are familiar.

It seemed possible recently that the use of coal gas even as an emergency measure might be prevented by restriction in supplies. It now appears, however, that the Ministry of Munitions urgently needs in connection with the manufacture of explosives various materials, the creation of which involves at the same time the production of coal gas. Consequently it does not seem probable that supplies will for the present be limited or prices seriously increased.

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# MOTOR TRAFFIC.

## FITTING THE VEHICLE TO THE ROAD.

SOME OBSERVATIONS UPON THE RESTRICTION AND DEVELOPMENT OF VEHICULAR TRAFFIC.

The latter-day development of highway traffic in England, consequent upon the introduction of mechanical traction, has brought about a revival of the old controversy of whether the road should be adapted to the vehicle or the vehicle be adapted to the road. The innumerable public bodies responsible for the control of highways and vehicles in this country may be classified in two sections, one of which advocates the highways being improved sufficiently to enable them to withstand all reasonable exigencies of traffic, while the other believes in restricting the development of vehicles to the standard of the more or less defective roads over which they pass. The latter policy, as will be demonstrated, has been reflected largely throughout our highways legislation, with lamentable results.

The speedier and easier the means of locomotion and transport, the more readily can the industrial and commercial resources of a country be developed. The Romans and other nations of antiquity made the proper maintenance of highways one of the first considerations of the State, and their roads were improved commensurately with the development of traffic over them. Vehicles of all descriptions such as the skill and ingenuity of the time could devise were allowed unrestricted use of the roads; new forms of locomotion were encouraged, and the volume of traffic on the highways was the measure of a country's prosperity. Since the passing of the Romans from England our roads, which have been compared with the veins and arteries of a living organism, have never been under a comprehensive and efficient control. Neither have the regulations for vehicles been vested in one responsible authority. After centuries of neglect, when at last attention was directed to our highways and the traffic passing over them, a confusion of interests retarded effective legislation. To-day, despite the lessons of the past, progress in highway locomotion is restricted by similar influences.

### HOW BAD ROADS CRIPPLED TRADE.

During the Middle Ages the inland trade of England was crippled by the defective condition of the highways. Wheeled carriages for the conveyance of merchandise and general produce could be utilised only to a limited degree, and such as were in use were necessarily heavy and cumbersome to enable them to withstand the roughness of the ways—the vehicle had to be fitted to the road. The pack-horse was the chief means of transport, and the load which a horse can carry being considerably less than that which it can haul, the cost of carriage was an important consideration to the trader. As a consequence, it was cheaper in many instances to import commodities from abroad than to obtain them from distant parts of our own country. Ships could make the voyage to the ports of France or the Low Countries and return with heavy cargoes of the goods of the foreigner in less time than it took for the string of straggling pack-horses to journey to an inland town sixty miles distant from the metropolis. The pack-horses survived until the seventeenth century—striking testimony to the condition of the highways of mediæval England. Shakespeare has interpolated into "Henry V.," the description of the Rochester carriers and their pack-horses, which is an excellent delineation of inland transport in the time of Queen Elizabeth.

### PREJUDICE AGAINST VEHICLES.

Travelling was equally defective in the Middle Ages in England. Carts had been used by the Danes and the Anglo-Saxons for travel as well as for the transport of goods. Some of the roads made by the Romans were at that period probably in fair condition, and permitted of such vehicular traffic, the development of which received a serious set-back on the coming of the Normans. Great though the Normans were as builders and administrators, they appear to have given no attention to the improvement of either the roads or the vehicles using them. Indeed, in the latter connection, the Normans' ideas of chivalry impelled them to regard wheeled vehicles for travelling as effeminate innovations unworthy of notice. To them the horse-litter, for ladies of high rank, was the sole "carriage" needed. To the deliberate refusal to recognise the advantages of wheeled traffic may be ascribed the ruinous condition of the English highways in after centuries, for the roads—deteriorated into little more than trackways for horses and mules—were utterly incapable of accommodating wheeled carriages when at last the deep-rooted dislike to the latter abated. Thus prejudice against vehicles in the past was responsible not only for preventing progress in locomotion, but also for reducing the highways to a standard of inferiority analogous to the traffic using them—the road became as crude as the carriage.

### EARLY HIGHWAYS LEGISLATION.

Early attempts at highway legislation in England were feeble in the extreme, and quite inadequate to effect tangible improvement in the condition of the roads. One of the first laws relating to the roads was passed in the reign of Edward I., and ordered that the waysides should be cleared of trees, dikes, and other things likely to afford concealment for robbers. Absence of wheeled traffic without the towns, consequent upon the neglect of the country roads, had caused the latter to decrease in width in many parts of England through the unhindered growth of vegetation. So long as the passage-way permitted a horse to struggle along it, the "road" was good enough, or rather not too bad, for our ancestors. Highway robbery was never so rife as in the days of bad roads, when the impediments to travel reduced traffic to the narrowest limits and roads were lonely.

The best—or less bad—roads in Early England were those used by the pilgrims, which the various religious houses assisted to keep in repair. The Pilgrims' Way from Winchester to Canterbury—still in good condition in many places—is the most notable example we possess of an Early English road. The actual construction of the Way, however, goes back to pre-historic times.

In 1346 Edward III. granted the Master of the Hospital of St. Giles-in-the-Fields in London the right to levy for two years a toll upon all carts using the highways adjacent to the Hospital. These roads (now High Street and St. Martin's Lane) had become

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so deep in mire as to be impassable, and their condition was but typical of the state of English roads during the rainy seasons at that period. Henry VIII. passed Acts to "encourage" the repair of highways in Sussex, one of which permitted any person to lay out a new road on his own lands and to acquire the old highway as recompense. What tangible effect this had in improving the roads of Sussex history does not record.

In the middle of the sixteenth century expanding trade caused an increase of traffic on the roads, in spite of all obstacles, and it became obvious that something had to be done to get the roads into proper condition. An Act passed by Philip and Mary in 1555 decreed that "the highways being very noisome and tedious to travel in, and dangerous to all persons and carriages, every parish shall annually elect two surveyors of the highways to see that the parishioners, according to their own lands, abilities, farms, etc., send their carts, horses, men, and tools, four days in each year, for mending the roads."

Excellent in theory, the Act was futile in practice. Everybody's business was nobody's business. The annual road repairing became a sort of village holiday; those who did not care to work watched those who did. Farmers and others gathered as many men as they could by pay, ale, or persuasion, and repaired the roads about their own farms and lands, while the Queen's highway was left just as it was. Five other Highways Acts were passed in Mary's short reign. Legislation had really begun.

### THE DAWN OF REFORM—HOW A NEW VEHICLE CAUSED THE ROADS TO BE IMPROVED.

It is from Elizabeth's time that the dawn of reform in our highways may be dated. The four-wheeled coach was introduced from the Continent. At first it was the object of general ridicule, and the people, who had—like their ancestors before them—been used to travelling on horseback, regarded it very much in the light that our own generation regards the Bath chair—a conveyance only for the infirm. Hitherto, practically the sole vehicle used for road travelling was the long wagon, which first appeared in the time of Henry VI. This was a kind of caravan on four wheels, with two apertures at each side for windows, and was hauled by a team of five strong horses in single file, with two drivers to guide them. The long wagon was the recognised form of locomotion for country-women and infants, and invalids. It managed to get along somehow, and was equipped with a proper breakdown outfit. Beneath the body of the wagon was suspended a chest containing tools and tackle, so that when mishaps occurred through the roughness of the roads, the drivers, with their five horses and outfit of picks and spades, crowbars and chains, and other implements, managed to get the long wagon on the move again.

When the four-wheeled coach came along in opposition to the accredited and old-established custom of travelling on horseback, prejudice made a great fight against it. Prejudice might have won, too, and the four-wheeled coach have returned whence it came, as an unmitigated nuisance, had not Queen Elizabeth herself taken a liking to the novelty. The Queen acquired a four-wheeled coach for her own use. Where Her Majesty led her dutiful subjects followed—royalty was ever a pioneer of innovations. The four-wheeled coach became the sign of diginity and wealth, of rank and fashion, and the coaches came and went about London, creating as great a stir amongst the people as the first motor cars did in later times.

Now, the four-wheeled coach went along very well in the town, where there were roads of a sort; but when it got outside in the country highways the trouble began—the vehicle wouldn't fit the road. So legislation had perforce to be directed towards the improvement of the ways—the road was to be made to fit the vehicle! In all, nineteen Acts were passed for bettering the highways in Elizabeth's reign, the majority of them after the coming of the four-wheeled coach. To be sure, an Act was passed in 1601 (43 Elizabeth) to prevent "the effeminacy of men riding in coaches," but this, after being honoured in the breach, was repealed in 1625, in which year twenty hackney coaches were set up for public hire in the metropolis.

About this time the Thames watermen raised a great outcry against the coach, which they feared would divert traffic from the river to the road. In 1635 the sedan chair was introduced "to interfere with the too frequent use of coaches, to the hindrance of the carts and carriages employed in the necessary provision of the city and suburbs." The hackney coachman reviled the chairman, and the chairman reviled the hackney coachman; while coach and chair were alike anathema to the waterman.

### RELAPSE—MAKING THE VEHICLE FIT THE ROAD.

Progress in locomotion was actually taking place, and improvement in the roads was moving in its train, slowly but surely. Coaches became numerous, and the transport of goods by wheeled carriages became general—the pack-horse had had its day. Outside London travelling by vehicles increased, in spite of all hindrances. Then suddenly prejudice was revived, and the fantastic notion was conceived that the better way of "improving" the highways would be to preserve them from the normal wear and tear of traffic; so legislation was diverted from the roads to the vehicles using them, and all sorts of restrictions were levied upon wheeled carriages.

Fitting the vehicle to the road first became a hard and fast corollary of highways legislation in the reign of Charles I. In 1629 a proclamation was issued commanding that "No common carrier, or other person whatsoever, shall travel with any waine, cart, or other carriage with more than two wheels; nor with above the weight of twenty hundredweight; nor shall draw any waine, cart, or other carriage with above five horses at once." The proclamation of 1629 was really a repetition of one which had been passed seven years previously by James I., and imposed similar restrictions because "the highways were ploughed up and the bridges shaken by 'unreasonable' carriages."

The condition of the highways when these remarkable edicts went forth—seeing that it required "five horses at once" to draw a two-wheeled cart carrying a load of one ton—was eloquent tribute to the policy of fitting the vehicle to the road.

### FURTHER HIGHWAYS LEGISLATION

During the Civil War, which broke out some few years after the passing of the above-mentioned Act, the roads became infinitely worse, for they had to withstand the stress of every form of military traffic, and restrictions upon vehicles in war time went the way of a good many other peace-time regulations.

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When the Restoration took place, highways legislation was at once forced upon the attention of Parliament again, and the Turnpike Trusts were evolved. The first Act in this category was passed in 1663, when the condition "of the ancient highway and post road leading from London to York and thence into Scotland" was, "by reason of the great and many loads which are weekly drawn in waggons," "very ruinous and almost impassable," as were indeed the highways of the country generally.

Syndicates were formed for the purpose of maintaining sections of the roads in proper repair, the money thus disbursed being recovered by the levying of a toll upon the traffic passing over the particular highways dealt with. The measure of 1663 was attended with a certain amount of success. The state of the roads about this period may be gathered from the fact that William III. formed what is now Rotten Row, in Hyde Park, as a private road to facilitate His Majesty's journeyings between St. James's and Kensington, the regular "king's highway" through Knightsbridge being absolutely unfit for use. In 1706 what is known as the first Turnpike Act proper was passed, with the result that over 1,100 Turnpike Trusts were established in England and Wales, with something like 23,000 miles of roads under their charge. The roads at last seemed in a fair way to become capable to meet the requirements of traffic.

### MAKING THE VEHICLE ROLL THE ROAD.

Although the roads were improving, the development of wheeled traffic was retarded by all sorts of perverse regulations. Every Act for the control of the highways bristled with them, particularly after our legislators conceived the brilliant idea that certain vehicles could be utilised for "levelling" the roads over which they travelled. The construction of wagons with wheels of inordinate width was encouraged, and special privileges—such as exemption from the highway tolls and the right to carry increased weights—were accorded to them. The stage wagon lumbered along on wheels sixteen inches wide, carrying a load of eight tons, and drawn by as many as ten horses. This unwieldy vehicle was permitted to have conical wheels (i.e., wheels with the outer diameter several inches less than the inner) which were supposed to be able to bear a greater weight than those of the usual cylindrical form. Instead of levelling the roads, these conical wheels literally tore them into ribbons. In consideration for this public service, wagons with 16-in. wheels were allowed the free use of the turnpike roads for one year, a period which was afterwards increased to five years. Then there were the "stragglers," or wagons having a wider gauge for the rear wheels than for the fore wheels—considered more effective for rolling the road—which were allowed to carry heavier loads than vehicles with both sets of wheels of one gauge.

The old Highways Acts were the origin of the adage that a coach and four can be driven through any Act of Parliament. The width of the wheel regulated not only the weight to be carried, but the amount of toll a vehicle should pay. There were graduated scales all in favour of the big wheel—which "rolled the road"—in both cases. The wainwright overcame the question of the limitation of loads by giving particular attention to the design of wheels. All sorts of fantastic innovations were made in wheels generally. There were conical wheels with extra wide felloes and triple tyres, the middle tyre projecting an inch or so beyond the two others; wheels with large raised studs on the tyre; and wheels, conical or cylindrical, of every pattern such as the skill and ingenuity of the wheelwright could devise, in order to derive advantage from the absurd clauses of the Highways Acts. Vehicles with normal wheels, doing little or no injury to the roads, were penalised both as regards the weights they were to carry and the amount of toll to be paid.

The wagon with 16-in. wheels carried eight tons, and travelled free of toll; that with 9-in. wheels carried 6½ tons and paid full toll, as did those with 6-in. and 4½-in. wheels, which carried loads of 4¾ tons and 4¼ tons respectively. These were the weights for the summer months, the winter loads being less.

Our latter-day highway regulations afford a very interesting analogy. The heavy steam-driven traction engine, with corrugated iron-tyred wheel of great width, hauling a train of trucks—each carrying several tons—makes no contribution towards highway maintenance, simply because steam is the motive power employed; whilst petrol-driven vehicles of every kind are compelled to pay heavy taxes—on their petrol, ostensibly—towards the upkeep of the roads, to which they cause infinitely less wear and tear.

### TRIUMPH—THE ROAD IS MADE TO FIT THE VEHICLE.

Now, all attempts to adapt the vehicle to the road in the past had the result which might have been anticipated—the roads became worse. The faction of the road blamed the vehicle, and the faction of the vehicle blamed the road. Our highways legislators considered that the proper maintenance of highways was not an art requiring skill and science. There were some, however, who were induced to think otherwise.

About the beginning of the nineteenth century McAdam—greatest and most sensible of road-builders—appeared upon the scene, and demonstrated the futility of enforcing a hundred and one restrictions upon vehicles—the loads they were to carry, the width and form of their wheels, the weights of the vehicles themselves, and the like—while the main point at issue, the surface of the roads over which they were to travel, did not receive adequate attention. Dealing with the roads around the metropolis, McAdam pointed out that they were constructed chiefly of gravel, which was a defective material because it contained earth, and the component parts being of very unequal size, and of a round form with no points of contact, coalescence and the formation of a smooth surface could not be obtained. Consequently, the roads whereon traffic was heavy were always loose and needed constant repair, and no matter what attention was given to them, unless the roads were made of the proper material, properly laid down, they could never be satisfactory. McAdam said, in brief, that the road should be fashioned to the vehicle, and the authorities, in a lucid interval, listened to him, and macadamised roads came into existence. McAdam laid it down as an important part of his system of road-making, that when roads were newly made up they should not be left to chance and be put in repair only when they became impassable, and therefore be entirely reconstructed, at great expense; but that a new road, made on his principle, should be watched for some considerable time after it had been constructed, and as soon as it

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# MOTOR TRAFFIC.

showed the slightest signs of wear and tear every inequality should be at once filled up, until a hard and level surface had been obtained. Under these conditions, said McAdam, a road would last for years without further attention, and it would be immaterial what weights or wheeled vehicles travelled over it.

Things transpired just as McAdam had foretold. Parliamentary and local legislators grumbled less about the vehicle, and concentrated their attention upon the road which it used. By adopting McAdam's system of road-making, the highways were improved out of all knowledge, and by the second decade of the nineteenth century the roads of Britain had attained a condition of excellence such as had been undreamt of in the past. Coaches performed the longest journeys in almost incredible time, and the rapid transport of goods by road was an important factor in the increase of commerce and industry. When at last, through the medium of steam, new methods of locomotion were devised and railways introduced, the highways of Britain occupied an importance in the sphere of national activities such as had never been attained in any other period of history—*the result of fitting the road to the vehicle.*

It remains to be said, however, that the deep-rooted prejudice against new vehicles never quite disappeared. In 1828, when the practibility of steam locomotion on the roads was demonstrated, keen opposition was manifested in many spheres to steam-propelled carriages. The road authorities were up in arms against them, and influenced Parliament to levy excessive tolls upon the new vehicles. A committee set up in 1831 advocated the equalisation of tolls upon all carriages, whether horse or steam, but its recommendation was ignored, with the result that the steam-carriages were driven off the road, contracts already made for their construction were annulled, and the motor-car industry, on its original inception, ruined by bigotry and prejudice.

Enactments regarding the wheels of vehicles lapsed when the General Highways Act (5 and 6 William IV., c. 50) was introduced in 1835. The Act of George IV., passed some twelve years earlier, began by having a good third of its clauses devoted to restrictions upon vehicles—the road was more or less a secondary consideration to the framers of this "Highways" Act.

Had railways in their early days been controlled by methods similar to those which obstructed the development of our roads in past eras, they would never have advanced beyond the stage of the "Puffing Billy" and the "Rocket." Permanent way and rolling stock were improved commensurately, improvements in the latter were never retarded by shortcomings in the former—the railroad is made for the train which passes over it.

### PRESENT DAY RESTRICTIONS UPON TRAFFIC.

Attempts to make the vehicle fit the road are not unknown in present-day highways legislation, largely as a result of the multiplication of authorities responsible for the control of our roads and the vehicles using them. While the development of motor traffic has led to a great improvement of the highways in areas where the authorities have endeavoured to cope with the new conditions, in other districts the idea appears to prevail that the ordinary water-bound macadam road which proved good enough in the era of horse traction should suffice for latter-day motor traffic, and that if it prove unable to withstand the stress, then the life of the bad road should be prolonged by restrictions being placed upon the vehicles using it.

During the past three years the roads of Great Britain have been subjected to a traffic without precedent in its vastness. Apart from the great increase in commercial and personal locomotion by road, an enormous military transport traffic has come into existence. Even the best of roads would not be impervious indefinitely to such a strain; that inferior roads have succumbed to it is no matter for surprise. Recent experiments have demonstrated that a road constructed on McAdam's principle, but with a surface composed of artificial asphalt prepared from refuse-destructor clinkers bound with special bitumen, is capable of withstanding the heaviest traffic of mechanically propelled vehicles, and is far less costly to maintain than is the ordinary broken-granite road. When road making is standardised, and the highways throughout the country partake of the same character—and that the best the road-constructor can devise—there will be some grounds of justification for placing limitations upon heavy vehicular traffic; but while all demands in the latter connection emanate from those in control of defective highways, it would appear as though the futile policy of "fitting the vehicle to the road" still has its protagonists in certain quarters.

When we consider the important part that the highways of this country have played during the present crisis, and realise the measure of their contribution towards the easement of traffic on the congested railways, it cannot but kindle amazement to think that there are public servants who regard with favour the discredited idea of "Fitting the Vehicle to the Road."

## AMERICAN MILITARY TRUCK CONFERENCE.

The American Society of Automotive Engineers recently held in Washington a three-day conference of truck, engine, transmission, axle, frame, and accessory manufacturers, for the purpose of co-ordinating the production of the units to be installed in the U.S. Government military trucks. The purpose is to bring about interchangeability of these truck elements so far as possible, rather than to standardise them fully. Interpretations of the War Department specification (which was published in full in our issues June 14 and July 12) satisfactory to all will, it is believed, be the result of this conference. Several of the transmission manufacturers believe, however, that their product can be completely standardised.

One of the interesting developments is stated to have been a general expression of opinion that it is practicable to standardise length and width of the military truck leaf springs. This had never been attempted or proposed seriously before. Next to tires, springs require replacement on military trucks more frequently than anything else. Another interesting result of special study is an air cleaner to be installed at the carburetter inlet to keep the astounding amount of dust collected in military truck service out of the engine. In general the truck units will be co-ordinated as far as possible without delaying prompt general production. According to an S.A.E. bulletin the Government will be supplied with as many trucks of a suitable type as it can possibly need.

A sub-committee, constituted of members of the Society of Automotive Engineers, is now at work in Washington checking up the detail mounting dimensions proposed at the last meeting. Quarter size drawings of the trucks are being prepared for general use.

VALUE OF MOTOR CARS TO TRAMWAY MANAGERS.—At a meeting of the Oldham Tramways Committee the chairman, Councillor Cheetham, referring to the record tramway receipts at Whitsuntide, said that one of the great advantages of having a motor car was that the management was able to keep a close eye upon the traffic. Mr. Priestly, the manager, estimated that at least £50 of increased revenue had been secured owing to the fact that by the use of the car they were able to keep in close touch with the traffic and to transfer the tramcars from one section to another as required.

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# MOTOR TRAFFIC.

## PETROL-ELECTRIC OMNIBUSES.

Among the motor vehicles whose reputation for reliability and low working cost has been enhanced by the heavier traffic engendered by the war the Tilling-Stevens takes a high place. In the metropolis an increased number are engaged in public passenger and industrial work, particularly on the roads connecting with the Royal Arsenal at Woolwich. In the provinces, too, municipal and private users have been supplied with as large a number as the Ministry of Munitions have from time to time been able to release from production for Government purposes.

An illustration is given on this page of a petrol-electric vehicle recently supplied to the Wolverhampton Corporation Tramways Department by Tilling-Stevens, Limited, of Maidstone, and Victoria Street, S.W. The body is of the most up-to-date type of single-deck construction, which alone would render it popular with the public, who are also keenly appreciative of the smoothness of control of the petrol-electric machine. This feature has an important bearing on the question of maintenance and working costs.

**Tilling-Stevens Petrol-Electric Omnibus Purchased by Wolverhampton Corporation.**

## BIRMINGHAM AND MIDLAND OMNIBUSES.

At the annual meeting of the Birmingham and Midland Omnibus Company, which is controlled by the Birmingham District Power and Traction Company, Mr. C. S. B. Hilton (chairman) said that the services had been reduced, and the less remunerative mileage had been eliminated. Fares had been increased, and the result was that the company was able to pay a dividend of 5 per cent. on the ordinary shares. It was probable that further restrictions of traffic would have to be made during the present year. Every omnibus in regular service contributed in taxes from £50 to £60 per annum, or about one halfpenny per mile run, which ought to be spent in road maintenance, but during the war it had been diverted to other objects. Meanwhile individual road authorities were endeavouring by other means to compel omnibus owners to contribute to road maintenance in addition to the heavy sums paid to the local rates. This was very undesirable, and he hoped it would be strongly resisted.

Increase for Maintenance.—The City of London Corporation has agreed to an increase of 33⅓ per cent. on the maintenance contract for its six Thornycroft wagons as from April last.

## U.S.A. MOTOR EXPORTS.

Great Britain the Heaviest Buyer in March.

In March last the United States shipped motor trucks, passenger cars, and parts to the value of 10,030,973 dollars, compared with 6,897,086 dollars in February, and 10,494,365 dollars in March, 1916. There were 1,040 trucks exported in March, as compared with 784 in February, amounting in value to 2,961,389 dollars, as compared with the February value of 2,128,865 dollars. The shipments, however, are not as large as in March, 1916, when 1,878 commercial vehicles were exported, valued at 4,909,179 dollars. Passenger car exports were increased nearly 66⅔ per cent., while truck shipments were increased over 50 per cent.

Notwithstanding the prohibition of motor car imports in this country except under licence, the American return states that the United Kingdom was the largest purchaser in March, her purchases increasing over 1,500,000 dollars. Canada doubled her purchases during March, the total exports to that country being 1,208,655 dollars, compared with 526,767 dollars. Chile was the biggest buyer in South America. Australia tripled her purchases, being third largest in point of American automobile and truck purchases, which totalled 365,527 dollars, compared with 127,388 dollars in February.

For the eight months ended March, the United States shipped 85,614,953 dollars worth of automobiles, trucks, and parts, compared with 89,723,953 dollars in the corresponding period in 1916. Though the value decreased, the number of cars and trucks are practically the same, namely, 55,143, as against 55,140 for the 1916 period.

## HALFPENNY OMNIBUS FARES WITHDRAWN.

The London General Omnibus Company abolished halfpenny fares on their omnibuses as from July 9, as well as fares with halfpenny denominations, such as 1½d. and 2½d. The maximum distances for 1d., 2d., etc., are not altered. The change was made owing to the difficulty of collecting fares on the omnibuses which are so heavily loaded because of the reduction in their number. The withdrawal of halfpenny fares, it will be noted, follows on a similar course in regard to London tramway fares, but on the tramways there are still 1½d. and 2½d. fares.

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# MOTOR TRAFFIC.

## HILL CLIMBING EXTRAORDINARY.

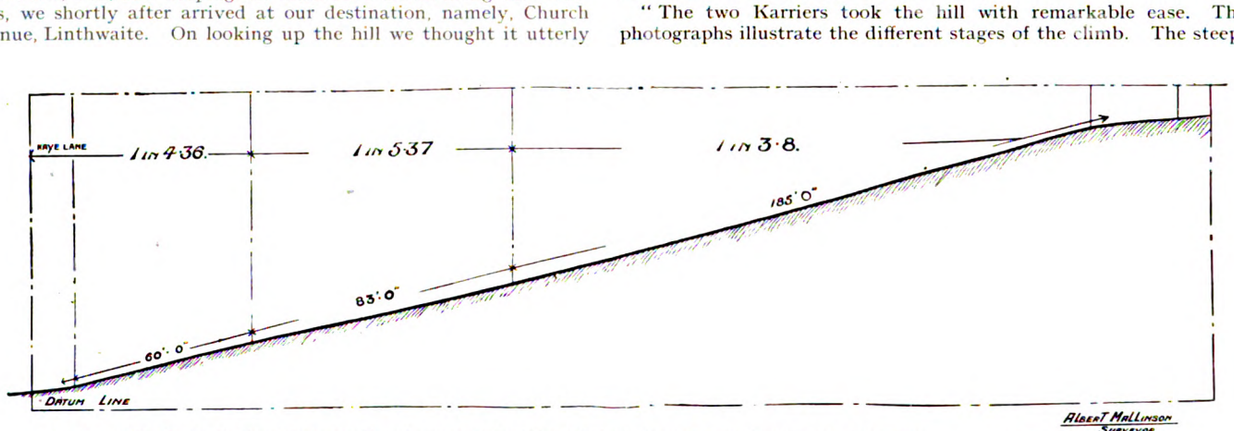
LOADED KARRIER LORRIES ON A GRADIENT OF 1 IN 3·8.

The accompanying illustrations and diagram represent admirably a notable performance of two Karrier live-axle lorries built by Clayton and Company (Huddersfield), Limited, to the standard specification W.D.S. The photographs indicate forcibly the severity of the test, and the account of a correspondent which we append is in its terse and unadorned narrative sufficient commentary on a feat of which the makers of the lorries may well be proud.

"We left Karrier Works, turned along St. Thomas' Road to the right until we came to Longroyd Bridge, and then turned to the left along the Manchester Road. From this point the Manchester Road is uphill all the way. Immediately after passing under the railway bridge we noticed the road branched to the right and left. We kept to the right, and soon passed the Warren House, which, by the way, is close to the bottom of a steep road with a very bad surface known as Deep Lane, Huddersfield, up and down which Karriers are regularly tested. We kept to the main road, and could see Deep Lane cutting its way like a path, as it were, along the side of a cliff, gradually getting higher and higher above our heads until it took a sharp upward grade and disappeared out of sight. On looking on our right we were surprised to see how high we were climbing all the way, for we could see many busy districts lying away down some hundreds of feet below. We didn't stop here. We were out to see an even steeper hill. About two miles farther on we left Cowlersley Lane on the left, and, still keeping the main road ahead along the tramlines, we shortly after arrived at our destination, namely, Church Avenue, Linthwaite. On looking up the hill we thought it utterly impossible for a heavy vehicle to climb it. It starts at absolutely right angles to the main road, and there is no chance of getting a start at the hill by going back a few hundred yards, opening out and getting up speed. It isn't possible to take the right-angled corner at any speed. Consequently any heavy vehicle attempting to climb this hill must start from rest.

A Stop for Inspection on a Gradient of 1 in 3·8.

"The two Karriers took the hill with remarkable ease. The photographs illustrate the different stages of the climb. The steepness of the hill can be gauged from the fact that in most of the photographs one can see above the roofs of the houses which are half-way down the hill. The Karriers were stopped and re-started and reversed on the steepest part of the hill, which is 1 in 3·8, and the road just here is very rough and broken. In two of the photographs Golcar can be seen right away in the distance, and the hills beyond. After passing the steepest point of the hill, we bore slightly to the right, took another steep hill, and came out on the top road by Linthwaite Church. The lorries were loaded with 4-ton test weights. Not once during the climb was there the least indication of the water in the radiators having reached boiling point. As a matter of fact, it was quite easy to keep one's hand on the top of the radiator without the least discomfort."




Section of 36 ft. Main Street between Kaye Lane and Slant Gate in the Urban District Council of Linthwaite.

"Our visit to Karrier Works," adds our correspondent, "was an unexpected one, and the two vehicles were part of a weekly output. We saw each photograph taken, and were asked to look at the picture on the screen before the exposures were made, and can state that each is a genuine unfaked picture. The diagram of the hill was supplied by the surveyor of Linthwaite, and signed by him, and is drawn to scale."

At the Top.

OMNIBUS OWNERS' ASSOCIATION.—Application has been made to the Board of Trade for a licence to enable an association about to be formed under the name of "The London and Provincial Omnibus Owners' Association (Incorporated)" to be registered with limited liability without the addition of the word "limited" to its name. The association will take over the assets of the London Omnibus Owners' Federation and the Provincial Omnibus Owners' Association, watch over and protect the interests of owners of omnibuses, and promote the consideration and discussion of all questions affecting the business.

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Approaching the End of the Climb—Golcar can be seen in the Distance.

The Two Karriers were Stopped, Re-started, and Reversed on the Steepest Part of the Hill. The road just here is very rough and broken.



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# MOTOR TRAFFIC.

## STRAKER-SQUIRE MOTORS IN WAR SERVICE.

The important part played by motor transport in every phase of the stupendous world struggle, now unfortunately entering into its fourth year, cannot be overrated. All the leading motor manufacturers have had their resources severely taxed in an endeavour to keep pace with the demands from the various Government departments for new machines, while a large number of vehicles of approved type were commandeered in the earlier days, and have since done yeoman service. Hitherto the information obtainable

**Fig. 1.—The Arrival of "Les Anglais," August, 1914.**

on the destinations and performances of these machines has been very meagre, and only of a general character. Recently, however, there appears to be a disposition to allow more detailed information with regard to the work of individual manufacturers to be published. Taking advantage of the altered conditions, Straker-Squire, Limited, of Wilson Square, Blackfriars, London, have just issued a handsome brochure entitled "Our Part in the War," in which they indicate some of the services which Straker-Squire machines have rendered to the Allies in France, Belgium, and various parts of our Empire.

Beautifully printed in two colours—brown and blue—and well illustrated, the book is divided into sections or chapters, each dealing with a particular phase of the war. In the first phase it

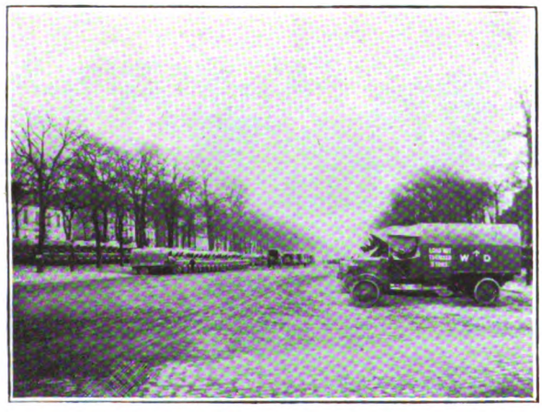

**Fig. 2.—A Park of Army Transport Wagons.**

is stated that "After the first shock of surprise was over the whole industrial world was drawn upon to meet the urgent need of the moment, and the war authorities, quick to recognise the important part the motor was to play in the great struggle, at once commandeered every suitable vehicle. Amongst the thousands of motor lorries and passenger vehicles taken scores upon scores of Straker-Squire machines were impressed into service by the Government, and this led to some curious anomalies in the fighting area in the early days of the war. Lorries and vans which up to that moment knew no more exciting experience than to ply in the streets of London or to deliver groceries in Surrey lanes suddenly found themselves within the zone of battle, and subjected not infrequently to shot and shell; and names and businesses familiar to every Englishman appeared in most unlooked-for places." A typical instance of this is shown in our first illustration, which depicts the reception accorded to the British soldiers by the inhabitants of a quiet town in northern France when proceeding to their station on a vehicle once owned by Messrs. Maple and Company. A number of other illustrations are given in this section of the brochure, each reproduced from snapshots taken within sound of the German guns, and during a time when the vehicles illustrated were being subjected to the most prodigious tests of endurance and reliability in circumstances which can truly be described as abnormal.

The war-worn machines, which Messrs. Straker-Squire state with reasonable pride came through the ordeal with flying colours, had soon to be replaced. Rapid developments in the production of new vehicles ensued, and with their works concentrating exclusively on the war model, the weekly output was more than doubled. Fig. 2 shows an impressive scene behind the front in France, where a large

**Fig. 3.—Straker-Squire Lorries with the Russian Army.**

number of army transport wagons are "parked." The "Straker" machines are seen on the right of the picture.

The second phase dealt with in the book refers to the use of Straker-Squire vehicles by our Allies in Russia, France, and Italy, and also in our overseas dominions. There are a number of illustrations showing some of these in service, and the variety may be gathered from the two illustrations here reproduced. Fig. 3 shows a fleet of wagons supplied to the Russian war department, and Fig. 4 a lorry filled with native soldiers taking part in the offensive in East Africa. Messrs. Straker-Squire claim that wherever our armies are engaged in the field their automobiles play an essential part in their daily existence and efficiency.

In the "Home Service" section of the book it is truly stated that "the maintenance of a fighting force in the field entails such a vast organisation at home, and has such numerous branches, that it is not possible to deal with them all in a record of this character." A good showing is made, however, and a number of illustrations make it clear that the Straker-Squire machines are

**Fig. 4.—Native Troops on the East African Front.**

well represented in each of the departments. Thus we are shown the type of machines supplied to the Admiralty, the Air Board, H.M. Stationery Office, and a number of typical examples in service for munition manufacturers. The care of the wounded has a separate chapter, and from this we gather that a large number of Straker-Squire ambulances are engaged in Red Cross work both at home and abroad. These vehicles, it is stated, have been selected for their speed and absolute reliability. In their build and arrangement everything has been done to ensure swift, easy running as well as absence of road trouble, and from the reports received Messrs. Straker-Squire are satisfied that the care and thought bestowed upon their construction has been fully recognised.

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# MOTOR TRAFFIC.

The final word in the book is reserved for the "Woman's part in the war." Under this heading three illustrations are given, each showing the active interest women are taking in the Straker-Squire machines on war service. It is claimed that they are exceptionally popular with women drivers, being easy to handle, smooth running, and free from breakdowns. Free copies of this interesting record can be had on application to Straker-Squire, Limited.

## EASTBOURNE MOTOR OMNIBUS RESULTS.

The accounts of the Eastbourne motor omnibus department for the past financial year are of interest as showing in a striking manner the effects of the petrol shortage upon the services instituted by a municipality which pins its faith entirely upon road motor traffic to the complete exclusion of tramways. The total cost of operation of the vehicles owned by the department has risen to an astonishing degree. Two years ago it was almost exactly 1s. a mile. Last year it had gone up only about ½d., but the comparatively low figure was due partly to the fact that the payment of instalments on omnibuses purchased out of revenue was almost complete. The rise in operating expenses between 1915 and 1916 was really in the neighbourhood of 2d. a mile. This year the total cost is just over 1s. 8d. a mile, of which about 3¼d. is represented by the payment of instalments and interest on loans. The running expenses, excluding the cost of repairs and maintenance, management, general expenses, interest and instalments are now slightly higher than the figure including all these items for the year ending March, 1915. This big rise is almost entirely attributable to the petrol shortage, which has led to a reduction in the mileage covered by the department's fleet amounting to about 40 per cent. of the mileage covered two years ago. This reduction has naturally driven up the standing charges per mile materially, and in producing this effect it has been enhanced in no small degree by the increased cost of labour. The running costs have also been pushed up by the fact that the shortage in petrol has been accompanied by a big increase in price. Whereas a concern of this kind before the war could contract for petrol at about 8d. a gallon, the cost is now more than three times that amount. The omnibuses remaining in service are by no means all of the newest types, and the consequence is that more than 4½d. a mile goes to the cost of fuel. Naturally the reduction in mileage run is accompanied by some degree of overcrowding of the vehicles which, despite the specially low terms offered to soldiers, involves a considerable increase in the takings per mile. These now amount to about 1s. 6½d., to which must be added rather over 2½d. a mile for income from other sources, making a total of about 1s. 9d. a mile, which is sufficient to meet the expenditure and to leave a balance of about 1d. a mile, or, in other words, a net profit on the year's working of about £670, as against a profit of about £4,000 last year. At present several of the old chassis owned by the Corporation are lying idle, owing partly to the difficulty of getting the necessary work of repair and reconstruction effected. It is to be hoped that it will not be long before the whole question of motor fuels is so thoroughly studied and taken in hand as to render impossible at any future date a repetition of the state of affairs that now exists. Petrol is not the only possible fuel, and it is high time that we realised this fact, and made adequate provision in the matter of alternatives. Meanwhile, and unless this is done, the prospects of the general extension of the use of motor omnibuses by municipalities are likely to be jeopardised.

## NAPIERS ON WAR SERVICE.

A speaking photograph is the term that may be applied to the illustration given on this page of a fleet of seven war-built lorries supplied to the War Department by D. Napier and Son, Limited, of New Burlington Street, W. These 30-cwt. machines are parked under the shelter of a wood alongside a road, and they are typical of the Napier military and commercial vehicles. The 30-cwt. lorries, as well as those of greater capacity, are rendering yeoman service in great numbers on all the fronts, and also for military work at home. Controlled and other business firms are also large users, thereby in many instances securing freedom from railway delays.

**A Fleet of Napier Lorries on War Service.**

## MOTOR SPIRIT RESTRICTIONS.

A Motor Spirit Restriction Order, issued by the Board of Trade on July 12, provides that no person shall use or consume any motor spirit for the purpose of proceeding to or from any race meeting, whether for the whole or part only of the journey. The distance between a person's place of residence, whether permanent or temporary, and the railway station nearest thereto from or to which he can conveniently travel to or from a race meeting is not deemed to be part of the journey. The Order does not prevent the driving or use of a public omnibus or stage carriage if such vehicle is actually plying for hire on its ordinary and accustomed route, and at its ordinary and accustomed hours.

The Petrol Controller has pointed out that of the total quantity of petrol imported not more than 10 per cent. is allocated for private cars, including motor cars and motor cycles used by doctors and veterinary surgeons, Government inspectors of munitions, food production, etc., Red Cross workers, and others engaged on certified work of national importance.

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# MOTOR TRAFFIC.

## MOTOR VEHICLES FOR MUNICIPALITIES.

WIDNES CORPORATION intend to purchase a 5-ton petrol lorry and trailer.

MANCHESTER WATCH COMMITTEE have resolved to purchase two petrol-driven fire engines.

ROCHDALE CORPORATION have under consideration the purchase of additional motor vehicles.

NORWICH COUNCIL have purchased a four-seated motor car for police and fire brigade purposes.

WARRINGTON TRAMWAYS COMMITTEE have invited tenders for the supply of a motor tower wagon.

TODMORDEN CORPORATION have under consideration the use of town gas as fuel for its motor omnibus service.

BOLTON COUNCIL have obtained tenders for the supply of a battery vehicle for the electricity department.

SALFORD CORPORATION have decided to purchase two motor tipping wagons for use in the cleansing department.

CIRENCESTER URBAN COUNCIL have obtained a motor vehicle for the purpose of facilitating the collection of refuse.

DERBY COUNCIL have received delivery of a 5-ton electric tipping wagon from the General Vehicle Company, Limited.

ISLINGTON BOROUGH COUNCIL have accepted the tender of the Lacre Motor Car Company for the supply of a motor road sweeper.

QUEENSBURY URBAN DISTRICT COUNCIL has appointed a special committee to consider the question of purchasing motor ambulances.

WEST HAM COUNCIL have received tenders for the supply of two motor ambulance vehicles for general accident and medical work.

PERTH CORPORATION have decided to purchase a flexible holder for use in its motor omnibus service, which it intends to run on town gas.

BOLTON CORPORATION have under consideration a proposal to purchase an electric battery van for use in the electricity department.

ROCHDALE COUNCIL have ordered a steam vacuum emptying machine for the cleansing of street gullies, in order to overcome the shortage of labour.

BLACKPOOL COUNCIL have taken delivery of an electric van which will be used by the cleansing department. It was supplied by the General Vehicle Company.

MARYLEBONE BOROUGH COUNCIL have placed an order with the Lacre Motor Car Company for a motor sweeper, and with the Austin Motor Company for four vans.

SOUTHEND COUNCIL have referred to a special sub-committee a proposal by the borough surveyor for the purchase of electric tip wagons for the collection of refuse.

MORECAMBE CORPORATION have agreed to purchase electric omnibuses to replace the horse tramway cars. The conversion cannot take place until after the war.

WOLVERHAMPTON COUNCIL are obtaining a steam wagon from Foden's, Limited, of Sandbach, at £895. The body will comprise a movable tank for street watering.

YORK TRAMWAYS COMMITTEE recommend the purchase of an additional motor omnibus to serve the Leeman Road district. Several battery vehicles are already in service.

HUDDERSFIELD COUNCIL have been informed by the Ministry of Munitions that the latter are unable to facilitate the proposed purchase of battery-propelled vehicles by the Corporation.

POPLAR COUNCIL have utilised the profits of the electricity undertaking for several years in order to establish a fleet of motor vehicles for the removal of clinker, house refuse, and road sweepings.

MANCHESTER CORPORATION have ordered a motor road sweeper from the Lacre Motor Car Company in order to decide whether the whole of the horse-drawn sweepers shall be replaced with motor machines.

BIRMINGHAM CLEANSING COMMITTEE are purchasing two 4-ton steam wagons from the Yorkshire Commercial Motor Company, at £720. The vehicles will be used for removing clinker from the destructors.

HULL CORPORATION have agreed to purchase a 1,000-gallon water tank for hauling behind a steam wagon, in order to keep up the watering of the streets. This work has been interfered with owing to the impressment of horses.

WALSALL GAS COMMITTEE have placed an order with Messrs. Alley and MacLellan, of Shrewsbury, for a 4-ton rubber-tired Sentinel steam wagon, for £825. The body will be provided with one-man quick hydraulic tipping gear.

## MOTOR TRAFFIC NOTES.

ELECTRIC VEHICLES FOR BUSINESS FIRMS.—After a lengthy trial, Messrs. J. Lyons and Company, Limited, the caterers, have decided to expend a large sum in replacing horses with electric battery vehicles.

COAL-GAS AS FUEL IN EDINBURGH.—The Scottish Motor Traction Company, Limited, have decided to equip a number of its vehicles to run on coal-gas. The machines so equipped will be confined to the short journey services.

EAST KENT OMNIBUS FARES INCREASED.—The working expenses of the East Kent Road Car Company having increased by 100 per cent., the fares have been raised to about 50 per cent. The company's vehicles run between Folkestone and other towns at the eastern end of the county.

ELECTRIC TIP WAGONS AT SOUTHEND.—The report of the borough surveyor upon the question of the purchase of electric battery tip wagons has been referred by the Highways Committee of the Southend-on-Sea Corporation to a special committee for further consideration.

PATRIOTIC GIFT BY THE ALBION COMPANY.—A 30-cwt. lorry has been presented to the National Council of the Young Men's Christian Association by the Albion Motor Car Company, Limited, of Glasgow. The gift will be of great service in the association's world-wide work among the British Army.

BRITISH WAR VEHICLES IN FRANCE.—It is estimated that there are 100,000 motor trucks serving the British army in France, and the number is being constantly added to. The census which has just been taken of steam wagons in the United Kingdom indicates an intention to largely augment the use of that class of vehicle for military work.

AN INDUSTRIAL ALCOHOL SCHEME.—At a national convention of the Strength of Britain Movement at Caxton Hall, Mr. C. J. Stewart, on behalf of the committee, laid before the convention the constructive proposals of the movement for the duration of the war. According to these there would be no necessity for State purchase of the liquor traffic. The distilleries would be used for producing industrial alcohol.

LESS PETROL FOR TRAMWAY DEPARTMENTS.—The Petrol Control Committee have reduced the allowance of petrol for the emergency power wagon of the Hull tramways from 132 to 88 gallons per month. In order to economise the supply, a horse-drawn wagon is used at night. The summer omnibus services in connection with Bournemouth tramways are being maintained as far as the supply of petrol will allow.

A WELSH OMNIBUS SERVICE AT A STANDSTILL.—Application has been made by the South Wales Transport Company to the Bedwas and Machen District Council for a renewal of the motor omnibus licences held during the past two years. As the running was suspended at the time of the application, the Council replied that they would consider the question of renewal when the company were able to restore the service.

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Mr. A. A. REMINGTON, of Wolseley Motors, Limited, has been elected chairman of the Technical Committee of Motor Industries. Lieut.-Col. R. K. Bagnall, R.E., is the vice-chairman.

H. G. BURFORD AND COMPANY, LIMITED—CHANGE OF ADDRESS.—In consequence of the Government taking over Trafalgar House, H. G. Burford and Company, Limited, have removed to 10, Regent Street, S.W., to which address all communications should be sent.

Mr. THOMAS BLACKWOOD MURRAY, a director of the Albion Motor Car Company, Limited, has received the degree of D.Sc. from Edinburgh University for his thesis, "Some Researches and Inventions in Hydraulic, Electrical, and Motor Vehicle Engineering."

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KARRIERS FOR HEAVY HAULAGE.—One of the most original and attractive advertising publications that we have recently received is a descriptive folder describing "Karriers" for heavy haulage. Within a plain tasteful grey cover, containing on the first page an effective drawing, is a sheet which when opened measures 20½ in. by 16 in., and displays well-executed photographic reproductions of a plan and elevation of a 50 H.P. 5-ton chain-drive type B.R. 110 industrial chassis manufactured by Clayton and Company (Huddersfield), Limited. Adjacent to the photographs is printed the specification, so that the reader has under his eye at a glance illustrations and particulars of this notable machine, which the company has designed for general heavy haulage. The engine is the largest fitted for British War Office specification. The folder also contains small views of a number of "Karrier" vehicles of various types. The booklet, which was written and designed by Mr. W. J. C. Stock, manager of the Karrier publicity department, is admirably printed, and is a first-rate specimen of good advertisement production.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, SEPTEMBER 13, 1917. VOL. XLII.

# THE TRAMWAYS OF SHANGHAI.

A BRITISH UNDERTAKING PROSPERING IN FACE OF DIFFICULTIES.

The electric tramway undertaking in Shanghai, owned by the Shanghai Electric Construction Company, Limited, is a remarkable example of what can be done by skill and energy even in spite of adverse conditions. In the eight years that have elapsed since the tramways were opened, Mr. D. McColl, the general manager, and his assistants have brought into existence a sound and profitable business—a feat the difficulty of which may be gauged from a glance at some of the comparative figures and a consideration of the local conditions as set out in this article. The solution of the problem, indeed, severely tested the management's resources in experience and ingenuity, and happily the results have quite exceeded expectations. The adaptability of the British race to all sorts of conditions is indeed well illustrated by such a case, where a few men are sent out to a place like Shanghai, and are able, by a study of the Oriental, added to administrative, financial, and engineering ability, to make a tramway a success in conditions of extraordinary difficulty. The present position may be indicated by a few figures from the last report of the company, that for the year ended December 31 last. The revenue was £115,006, after allowing no less than £38,751 for loss by exchange of subsidiary coinage into local dollars. After paying all expenses there was a profit of £48,123. A sum of £10,000 was transferred to renewals fund, £5,000 was written off preliminary expenses, and a dividend of 10 per cent. was paid to the shareholders.

Shanghai is situated on the Whangpoo, 12 miles up the river and 32 miles from the outer bar of the southern entrance to the Yangtsze-kiang. It is the commercial metropolis of North China, more than half of the whole trade of China being controlled there.

Typical Passenger Vehicles Seen in Shanghai.

By far the most important portion of Shanghai is that called the Foreign (or International) Settlement, the population of which at the last census in 1915 was 639,000. The area of the Foreign Settlement is 8⅔ square miles. It is administered by a Municipal Council, the membership of which is always overwhelmingly British, and does not now include a single German or Austrian. In the adjoining French Concession and areas administered by the Chinese authorities there is also a large population, and it is

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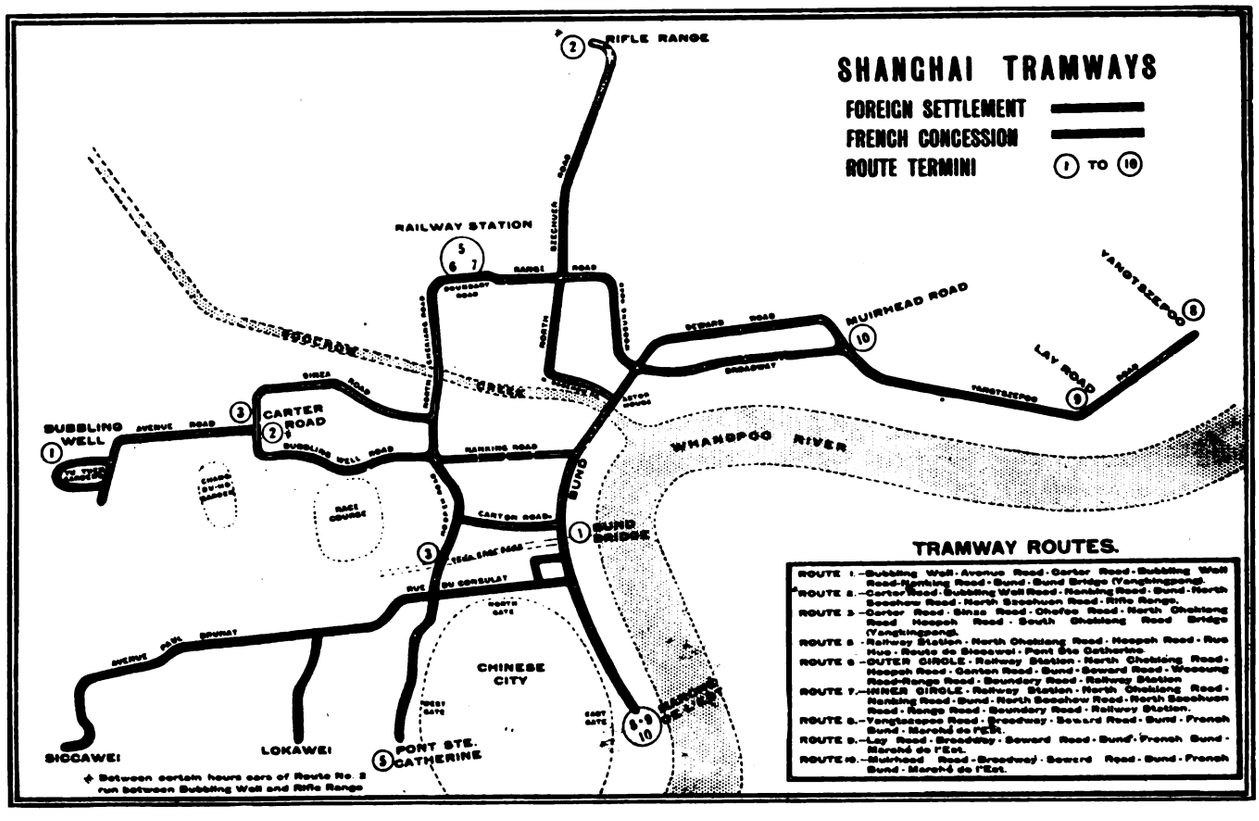
reckoned that the total population of Shanghai is well over 1,000,000.

The tramway concession, which was granted by the Municipal Council in 1905, provides that the concession shall be in force in perpetuity, subject to the proviso that at the end of 35 years, or of any subsequent period of seven years, the Council may purchase the undertaking as a going concern. By the concession the company is required to pay to the Council a royalty of 5 per cent. on the traffic receipts, to maintain the road surfaces on its tracks and to a distance of 18 inches beyond the outer rails, and to purchase from the Municipal Council the energy required for working the system. It also confers on the company the prior option for extensions, and requires that the undertaking shall not be owned or operated by other than a British company.

The Shanghai Electric Construction Company, Limited, was registered in London in 1905, with Sir Alfred Dent, K.C.M.G., as chairman, to carry the scheme into effect. The initial capital was £320,000, in ordinary shares. The work of construction was carried out by Messrs. Bruce Peebles and Co. Ltd., Edinburgh, and the lines were opened for traffic on March 5, 1908. In June of the same year Mr. Donald McColl came from the official staff of the London Underground Railways to take up the position of general manager. Mr. McColl had previously had varied tramway experience under the Glasgow Corporation and with the Lisbon Electric Tramway Company, Limited, following a commercial training with a large engineering firm in Glasgow.




### Track Construction.

The track owned by the company consists of 25·81 miles of track, of which 9·38 miles is double and 7·04 miles single line. No extensions of the tramway track have been made since the opening. The company's lines are shown diagrammatically on the accompanying map, and also those in the adjoining French Settlement. The track is of metre gauge, laid on a concrete foundation 6 in. deep, the road surfaces being generally of water-bound macadam with stone setts lining the rails on both sides. On about two miles of the main thoroughfares used by foreigners there is wood paving, the first used for road work in China. The rails are of British standard section, weighing 90 lbs. per yard. The soil is alluvial, and the tide rises on most parts of the route to within three feet of the road surface; the track on this account requires much attention.

After experimenting with different methods of welding the joints electrically, the management has devised a method whereby the old fishplates are welded to the rails, the electrodes used being also those of the company's design, and arranged so that the deposit of metal contains the same percentage of carbon as the rail itself. This system, whilst absolutely efficient, is materially cheaper than any other known to the management. Of about 2,500 joints so welded no failures have taken place. One joint in every eight is left unwelded as an expansion joint, and joints at curves, points, and crossings are also left unwelded. The welding of the track will be completed during the current year. An illustration of the welding machine is given on a following page.

### Overhead Equipment and Feeder Cables.

Steel tubular poles are used throughout with bracket-arm suspension for single track and span-wire suspension for double track.

The original bitumen-covered underground cables developed numerous defects as a result of more or less general decentralisation of the copper, and have been replaced by overhead cables. These are of bare stranded copper, run on the company's poles. Current is at present supplied from the Council's direct-current plant. Later, upon this plant being discarded, traction current will be supplied through sub-stations from alternating plant, when the company will provide underground feeders from the sub-stations to the lines.

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ROLLING STOCK.

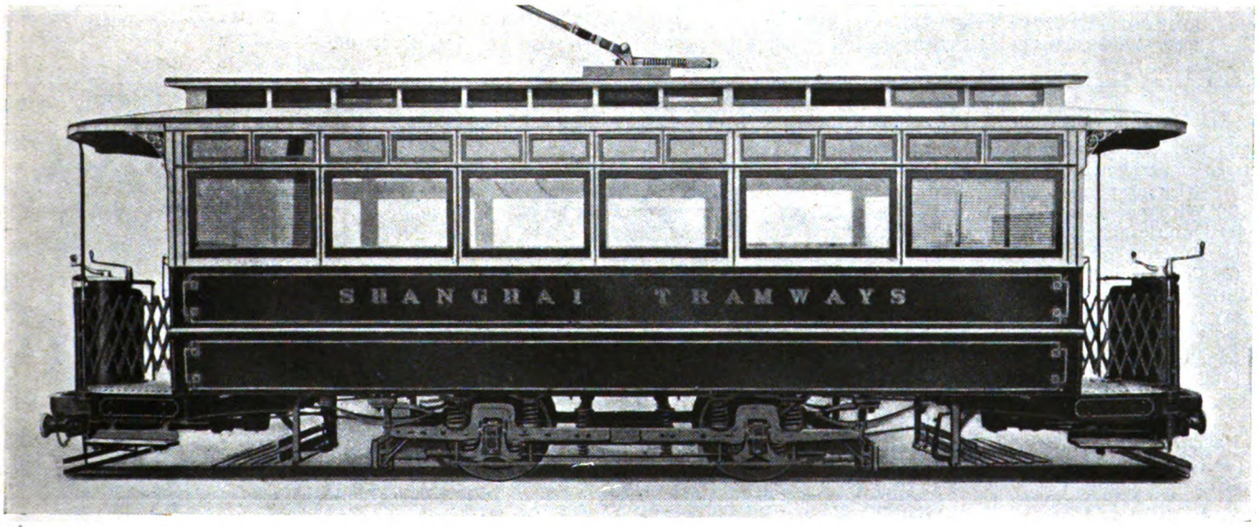
*Motor Cars.*—The service was opened with 65 single-deck cars of the single-truck, end-entrance type. These were built by the Brush Company, and equipped with Bruce Peebles and Company's motors and controllers. These cars have two compartments, with seating accommodation for 12 first-class and 20 third-class passengers. The weight unloaded is about 9 tons. When additional motor cars came to be required, a centre-entrance type of car, designed by the management to suit local requirements, was introduced. These cars are equipped with Brill radiax trucks and Westinghouse motors and controllers. The weight unloaded is about $9\frac{1}{2}$ tons. The 12 ft. wheel-base ensures freedom from oscillation, a disadvantage of the original type of single-truck car with rigid axles and 6 ft. 6 in. wheel-base. The seating accommodation of the new type is the same as that of the original type. There are now 25 cars of the new type whose bodies have all been built locally, making a total of 90 motor cars.

*Trailer Cars.*—Both one-compartment and two-compartment trailer cars are employed to suit traffic conditions on different routes. A two-compartment trailer attached to a motor car is shown in the accompanying illustration. As the lines are practically level, braking of the trailers is unnecessary for service stops, and no brakesmen are employed. The trailers are equipped with solenoids by means of which, on emergency application of the power brake by the motorman, brake blocks are applied to the four wheels of the trailer. There are 70 trailer cars, each weighing about $4\frac{3}{4}$ tons.

Centre-Entrance Motor Car with Trailer—Shanghai Tramways.

DEVELOPMENT OF THE SYSTEM.

When the tramways were opened, there were thousands of rickshas plying at very low fares. Each ricksha is pulled by one man and usually carries one passenger, and has the advantage from the passenger's point of view of taking him up and putting him down exactly where he wishes, whilst the tramcars are confined to taking up and putting down passengers at the authorised stopping-places on the main roads where there are




Type of First Cars Used in Shanghai.

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tramway lines. The problem was a difficult one, not only on this account, but also because of the extraordinarily low wages of the native population—the foreign population and the better-off Chinese formed an insignificant proportion of the total population—and it was necessary, if the tramways were to be a commercial success, that they should become popular with the masses of the native population. Another difficulty arose in connection with the Chinese copper coins in which the bulk of the fares had to be collected. These were undepreciated when the tramway concession was entered into, but by the time the system was opened they had fallen in value by about 10 per cent. (This was due to excessive issues of coins by the Chinese Government and to the coins not being redeemable at face value.) For the first year the gross receipts collected on the cars were reduced by about 15 per cent. owing to this depreciation; the second year showed a depreciation of 24 per cent., and it remained between 22 per cent. and 24 per cent. until 1913. In 1914 it jumped to 26 per cent., and in 1915 to 28½ per cent., and in 1916 it went down to 26¾ per cent. To enable home readers to appreciate this clearly, it may be said that every penny collected on the cars would be worth less than three farthings when lodged in the bank.

Applying this depreciation to the figures of all the tramway undertakings in the United Kingdom, the result would be that, with the same fares as at present, they would in the aggregate be insolvent. The Shanghai management could not attempt to offset the depreciation by an increase of fares, because the fares were found at the beginning to be really not low enough to attract an adequate volume of traffic, in view of the extremely low-paying capacity of the bulk of the native population and of the keen competition of rickshas at almost incredibly low fares. The manner in which Mr. McColl solved the problem would take too long to explain; experiments with sections, fares, and services, all in a given direction and in pursuance of a policy to develop a very large volume of traffic, extended over four years. The remarkable results speak for themselves.

| Year. | Car Miles. | Passengers. | Gross Receipts. | Effective Receipts. Mex. $ | Working Profit. Mex. $ | Dividend. Per cent. |
|---|---|---|---|---|---|---|
| 1909 ... | 1,979,001 | 11,772,715 | $ 557,630 | 441,541 | 47,736 | *Nil* |
| 1916 ... | 3,803,980 | 69,089,432 | $1,537,577 | 1,150,067 | 502,927 | 10 |

As volume is so important a feature of the Shanghai traffic, the following comparison is of interest:—

| Passenger Journeys Per Annum Per Mile of Route. | |
|---|---|
| Glasgow (1915-16) ... ... ... ... | 3,648,525 |
| Manchester (1915-16) ... ... ... ... | 1,748,252 |
| Birmingham (1914-15) ... ... ... ... | 2,224,519 |
| Liverpool (1915) ... ... ... ... ... | 2,250,085 |
| Average ... ... ... | 2,467,679 |
| Shanghai (1916) ... ... ... ... ... | 4,009,834 |

The following figures are also of special interest:—

| | 1909. | 1916. |
|---|---|---|
| Passengers per car-mile | 5·95 | 18·16 |
| Effective receipts per passenger | 3·77 cents. | *1·66 cents. |
| Effective receipts per car-mile | 22·31 cents. | 30·23 cents. |

* Equal to 0·43d.

The high occupancy of the cars is largely explained by the steady, all-day traffic which has been cultivated. The ratio of passenger miles to seat miles for 1916 was over 64 per cent. This in turn has ensured an excellent service factor which was as high as 49 per cent. for 1915; that is to say, the actual car service run (reckoned in car hours) was equal to 49 per cent. of the service which would have been run if the average maximum number of cars in service weekly had been running for 24 hours per day for the 366 days of that year. In computing mileage and the number of cars in service, trailers are treated throughout as separate cars; therefore one mile run by a two-car train is reckoned as two car-miles. Mr. McColl prefers this method to the continental system of reckoning every trailer mile as only half a car-mile.

### Monthly Tickets.

For the convenience mainly of foreigners, first-class monthly tickets are issued available for any number of journeys over all the lines at the following rates:—

Adults, 6 dollars per calendar month=about 12s. 9d.

Children under 16 years of age, 3 dollars per calendar month=about 6s. 4d.

About 1,100 adult tickets and 300 children's tickets are usually issued. The colour of the tickets is changed monthly.

### Accidents.

Notwithstanding the very heavy traffic, the record of accidents has steadily improved, as will be seen from the following table:—

| | 1916. | 1915. | 1914. | 1913. | 1912. | 1911. | 1910. | 1909. |
|---|---|---|---|---|---|---|---|---|
| Total passengers (thousands) ... ... ... | 69,089 | 59,750 | 55,647 | 47,686 | 40,734 | 27,257 | 18,751 | 11,772 |
| Number of accidents with other vehicles:— | | | | | | | | |
| (a) Without personal injury ... ... ... | 313 | 256 | 409 | 385 | 301 | 234 | 283 | 320 |
| (b) With personal injury ... ... ... | 25 | 29 | 43 | 52 | 69 | 55 | 64 | 44 |
| Personal injuries (unconnected with other vehicles):— | | | | | | | | |
| (a) Entering or leaving cars* ... ... ... | 172 | 198 | 209 | 225 | 252 | 240 | 177 | 85 |
| (b) Pedestrians in front of cars ... ... | 63 | 65 | 86 | 94 | 103 | 93 | 108 | 97 |
| Fatalities:— | | | | | | | | |
| (a) Knocked down ... ... ... ... | 10 | 8 | 3 | 9 | 9 | 4 | 4 | 4 |
| (b) Leaving cars in motion ... ... ... | 2 | 6 | 8 | 5 | 9 | 6 | — | — |
| (c) Boarding cars in motion ... ... ... | 1 | 1 | — | — | — | — | — | — |
| (d) Passenger leaning out and struck by passing car ... ... ... ... ... | — | 1 | — | — | — | — | — | — |
| Total accidents ... ... ... ... ... | 587 | 564 | 758 | 770 | 743 | 632 | 636 | 550 |
| Accidents per million passengers ... ... ... | 8·49 | 9·44 | 13·62 | 16·10 | 18·24 | 23·18 | 33·92 | 46·72 |
| Total personal injuries ... ... ... ... | 274 | 308 | 349 | 385 | 442 | 398 | 353 | 230 |
| Personal injuries per million passengers ... ... | 3·97 | 5·16 | 6·27 | 8·03 | 10·85 | 14·60 | 18·82 | 19·54 |

* Practically all accidents occurred owing to passengers entering or leaving when cars were in motion.

No extensions of track had taken place. The development of traffic continues, and the effective receipts in 1917 are showing an increase of about 15 per cent. over the corresponding period of 1916.

In only two of the verdicts at the inquests on the above fatalities was any blame placed on the motormen. Practically all fatalities resulting from being knocked down by cars have been to aged and often deaf natives

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A Complicated Junction.

Motor and Trailer Cars in a Main Street.

A Busy Junction.

Rickshas and Tramcars in Hanking Road.

Typical Views in Shanghai.

Two Bays at Bubbling Well Car Sheds—Shanghai Tramways.



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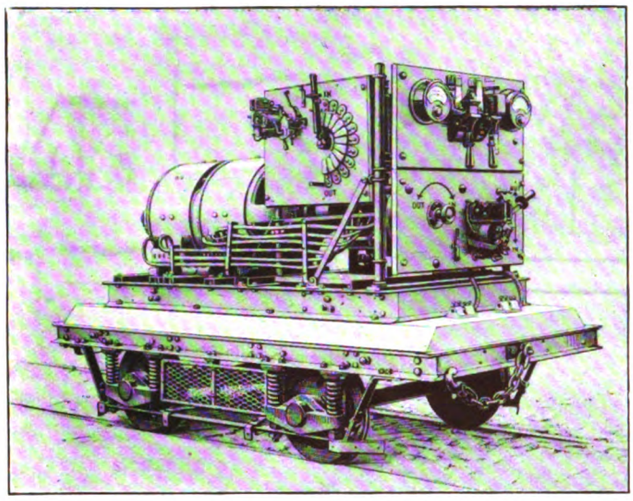
or to native children, and nearly all fatalities due to leaving cars in motion have been to natives from the country, who were wholly unacquainted with street traffic.

### Collection of Revenue.

In a country the natives of which seldom consider it anything but foolishness not to take advantage of



**Welding Machine Used by Shanghai Tramways.**

any opportunities for illicit gains, and where native passengers are more likely to co-operate with conductors to defraud the company than the reverse, the system of checking the collection of the revenue has to be as tight and complete as it can possibly be made. It would occupy too much space to detail the complete ticket check system of the Shanghai undertaking, but we are able to give the following summary of some of its more important features :—

(1) All tickets are printed by the company from specially made paper, the stock of which is closely controlled and the output in tickets checked with the issues of paper to the printing department.

(2) The total and journey way bills, although separate, are produced by the one writing, and therefore correspond. The former remains in the cash office whilst the conductor is on duty.

(3) A conductor cannot anticipate the series and numbers of the tickets to be supplied him.

(4) It is ensured that the way bills for all the duties worked by conductors have been received and settled for.

(5) It is checked that there are no unexplained gaps between the last numbers of the tickets on the way bills of one day and the first numbers on the way bills of the corresponding boxes (issued to different conductors) on the next day of issue, so that tickets cannot be issued with unofficial waybills and unaccounted for.

(6) Intelligent and well-trained ticket inspectors of other races than that of the conductors.

(7) Daily detailed verification of banked receipts.

(8) Daily scrutiny in the head office of a number of tickets collected from passengers, with a view to detection of any spurious tickets.

(9) Monthly comparison of ascertained ticket stocks with balances of ticket stock accounts to which all tickets printed are debited, and all tickets sold, as per official traffic returns, are credited.

That 18·16 fares per car-mile were turned in during 1916 is evidence of the efficiency of the system.

### Working Expenses.

The liberal use of trailer cars is one of the factors tending to keep down working expenses per car-mile, which for the year 1916 were as under :—

| | Per Car-mile. |
|---|---|
| Traffic ... ... ... ... ... ... | 1·10d. |
| General ... ... ... ... ... ... | 0·83d. |
| Repairs and maintenance ... ... ... | 1·41d. |
| Power (purchased) ... ... ... ... | 0·69d. |
| | 4·03d. |

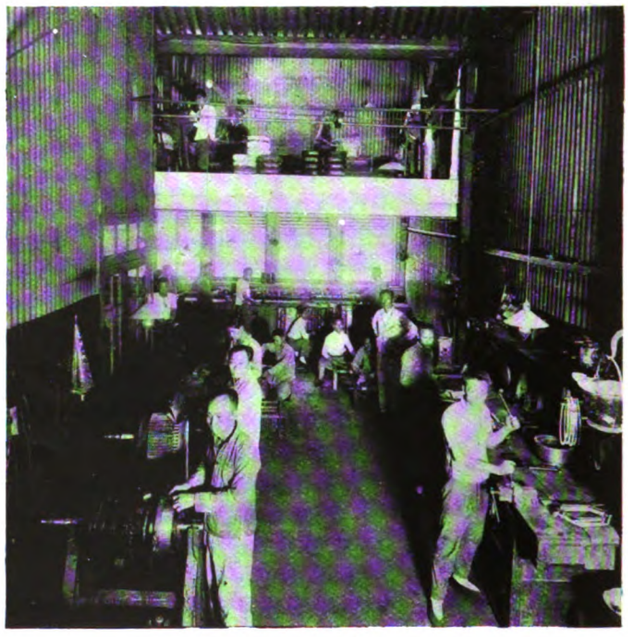
The ratio of trailer car-miles to motor car-miles for 1916 was 60·02 per cent., and is being gradually increased. Traction units per ton-mile for 1916 were 0·1129.

### Car Works.

Views of the works are given in Figs. 12-15. Each car receives a mileage overhaul after it has run 3,000 miles, which it does about every six weeks. As part of this overhaul tests on armatures, field coils, rheostats, and through all equipment from trolley wheel to earth cable are carried out as follow :—

| | |
|---|---|
| Armatures ... ... | Bar to bar and insulation tests. |
| Field coils ... ... | Resistance and insulation tests. |
| Rheostats ... ... | Resistance and insulation tests. |
| Equipment ... ... | Insulation test. |

**Carpenters' Shop.**



**Armature Shop.**

Continuous records are kept of these tests. Mileage records of all important parts of equipments are also kept

All armature coils are made up in the company's works, as also are the field coils, the latter being stripped of old insulation, re-insulated, and re-wound when necessary.

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Machine Shop—Shanghai Tramways.

Interior of Bubbling Well Car Shed—Shanghai Tramways.

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The company has its own brass foundry, and casts its own trolley wheels, journal brasses, check brasses, etc., as well as all parts for overhead equipment of line.

During the day extensive use is made of the electric welding plants employed at night for welding rail joints, and countless parts are thereby saved from the

**Donald McColl,**
*General Manager, Shanghai Electric Tramways.*

scrap heap. Oxy-acetylene welding is also employed but only for work for which electric welding is not suitable.

### Ticket Printing.

The company prints all its own tickets, and also those for the neighbouring tramway system in the French Settlement. The ticket printing machine is of the rotary type, using rolls of fairly thin paper 3⅔ in. wide. It prints 360 tickets per minute, and runs day and night. Since the commencement of the war it has been necessary to have the paper made locally, but the paper mill could not undertake to supply it in rolls of less than 92 in. wide. The Tramway Company had therefore to make its own arrangements for cutting the 92 in. rolls into 3⅔ in. rolls suitable for the printing machine, and it designed, and made in its own shops, the motor-driven cutting machine.

### Railless Electric Traction.

A narrow, busy thoroughfare, regarded as unsuitable for tramways, was equipped for railless electric traction, the road being relaid by the Council in cement concrete, towards the cost of which the company contributed one-half. The service was opened on July 6, 1915, with the cars reduced from their original weight of 4¾ tons to 3¾ tons by the removal of one of the two 20-H.P. motors, the adoption of a branch trolley head with only one trolley base and pole instead of two, and a number of minor changes. This head was designed by the company in Shanghai, and gives excellent service. The cars (Fig. 16), of which there are seven, were built by the R.E.T. Construction Company, Limited, the general arrangement of body, lifeguards, etc., being to the drawings of the Shanghai Tramways. The cars have operated with remarkable success and safety in the congested thoroughfare on which they run. The electrical equipments are by Dick, Kerr and Company, Limited, and give complete satisfaction. A short extension was opened on September 21, 1916, making the total length of the route slightly over one mile. Since the opening of the extension the route has carried the extraordinary heavy traffic of practically five million passengers per mile of route per annum, a wonderful tribute to the efficiency of such cars. The company hopes to be able in the future to develop this form of traction, and also to conduct a considerable freight business by means of railless vehicles, a special type of which is being designed to suit the local conditions.

### Directors.

The London board consists of Sir Alfred Dent, K.C.M.G. (chairman), Emile Francqui, R. S. Portham, M.I.C.E., J. S. Haskell, and Chevalier Edmond Carton de Wiart.

The local board consists of:—Edward Wheeley (chairman), L. J. Cubitt, G. M. Wheelock. and R. McE. Dalgleish. The secretary of the company is Mr. L. W. Hawkins, Basildon House, Moorgate Street, E.C.

### Staff and Employees.

The company's foreign staff of trained tramwaymen from home numbers 14, of whom there are three on

**J. S. Smeeton,**
*Deputy General Manager.*

**E. Carroll,**
*Traffic Manager.*

**H. J. Blatchford,**
*Line Engineer.*

**J. L. Gordon,**
*Rolling Stock Superintendent.*

active service, whilst the others of military age have volunteered but cannot be spared. The office staff is largely Portuguese. There are about 1,100 Chinese employees; the majority of the traffic inspectors are Koreans, whilst Japanese and Indians are also represented to a small extent.

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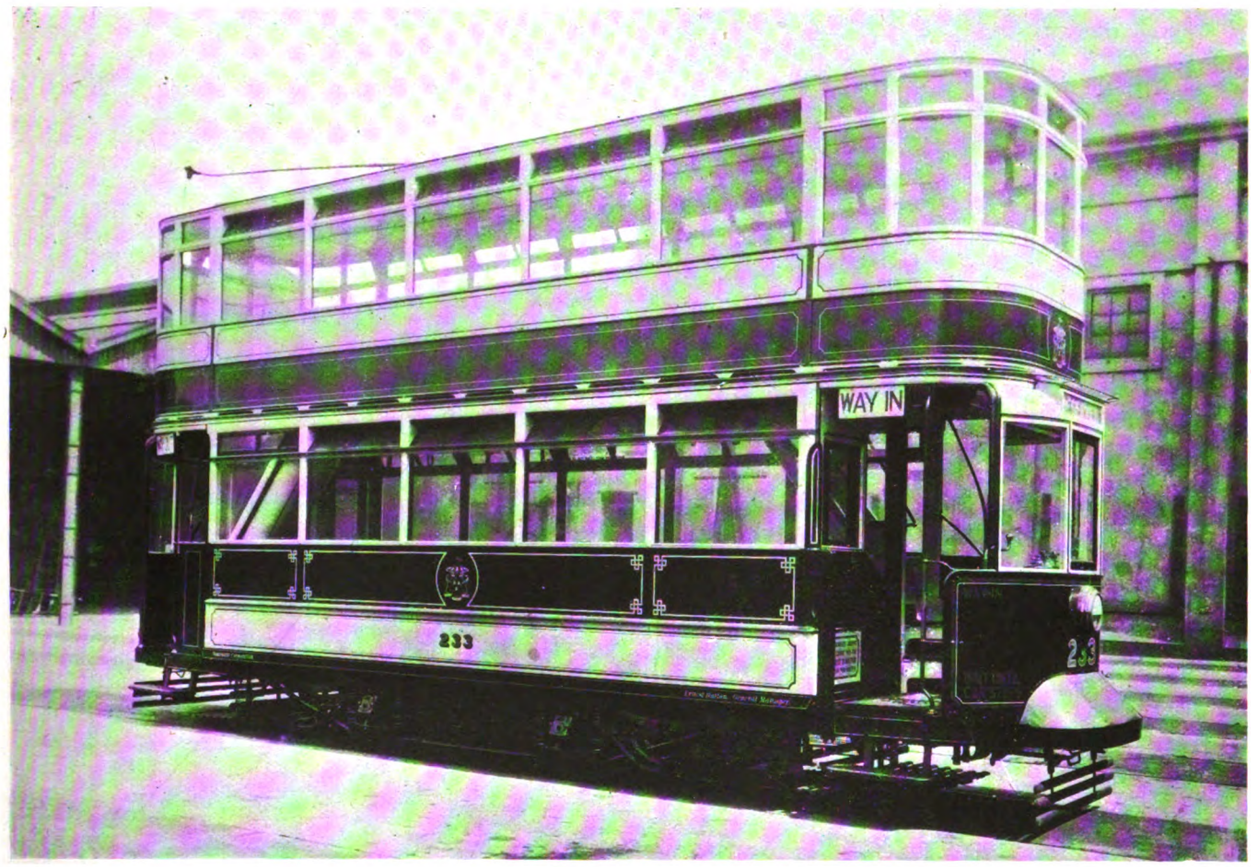
## AN IMPROVED CAR AT NEWCASTLE.

Amid the stress of vastly increased traffic resulting from the conditions incident to the war, the general manager of the Newcastle Corporation Tramways has found time to produce two new car designs which are of exceptional interest. As our readers may remember, Mr. Hatton found it exceedingly difficult to provide cars to carry munition workers, and at an early stage in the war he devoted much attention to the problem of reconstructing certain single-deck cars in order to carry more passengers and to make quicker journeys. The former object was secured by reducing the number of seats; the latter by the adoption of the front exit so often advocated in these columns.

The reconstructed cars were described and illustrated in our issue of April 13, 1916. At the outset, as was only to be expected, the introduction of the front exit did not escape some local criticism, but the continuation of the experiment has more than justified Mr. Hatton's innovation. As expressed in the entire absence of third party accident claims, the result has been so satisfactory that it should awaken the keen interest of managers who have annually to meet a large outlay on that account. The records of the Newcastle Tramways show that over a period of eighteen months, with seventeen front exit cars in service, not one accident to passengers boarding or leaving them has occurred. We may add that as the cost of compensation for third party claims on the Newcastle Tramways—largely the result of accidents in boarding or leaving cars—amounts to about £3,000 per annum, complete proof is afforded of the accuracy of our frequently expressed view that front exit operation will effect considerable saving in this direction.

As will be seen in the photograph of the exterior of the new front exit car, which followed the reconstructed type, the car, although mounted upon a single truck, has characteristics which resemble the bogie type. This is due partly to the adoption of the front exit and partly to the use of an entirely new form of staircase, the joint result securing a longer body and enabling the platforms to be made shorter.

Hitherto attempts at producing a double-deck tramcar with front exits have all been in the direction of lengthening the car platform, which is detrimental to the construction and life of the car body itself, owing to the extreme length of the cantilever arms supporting the platform; whereas in the car shown in our illustrations the construction is such that an entirely opposite effect is produced. An additional advantage is that the staircase being entirely enclosed, it is kept dry under all conditions of weather. The complete enclosure of the staircase also makes it impossible for a passenger to be thrown over the staircase rail into the roadway. The platforms have a closed front above the dashboard, so that the motorman is protected from wind and rain, and will thus meet the views of the employees, who in many places are pressing for protection. A method of temporarily closing the opposite side of the front exit platform is for convenience in illustration shown in the photograph on the same side as the entrance platform. The closure is effected by means of a portable door. The entrance is 2 ft. in width, and the platform 4 ft. 6 in., the body being 20 ft., giving a total length of 29 ft. This form of construction easily lends itself to a wheel base of 8 feet if desired, without requiring any alteration in the proportions of the platform arms. The seating capacity of the lower deck would be




**Exterior of Improved Front Exit Car—Newcastle Corporation Tramways.**

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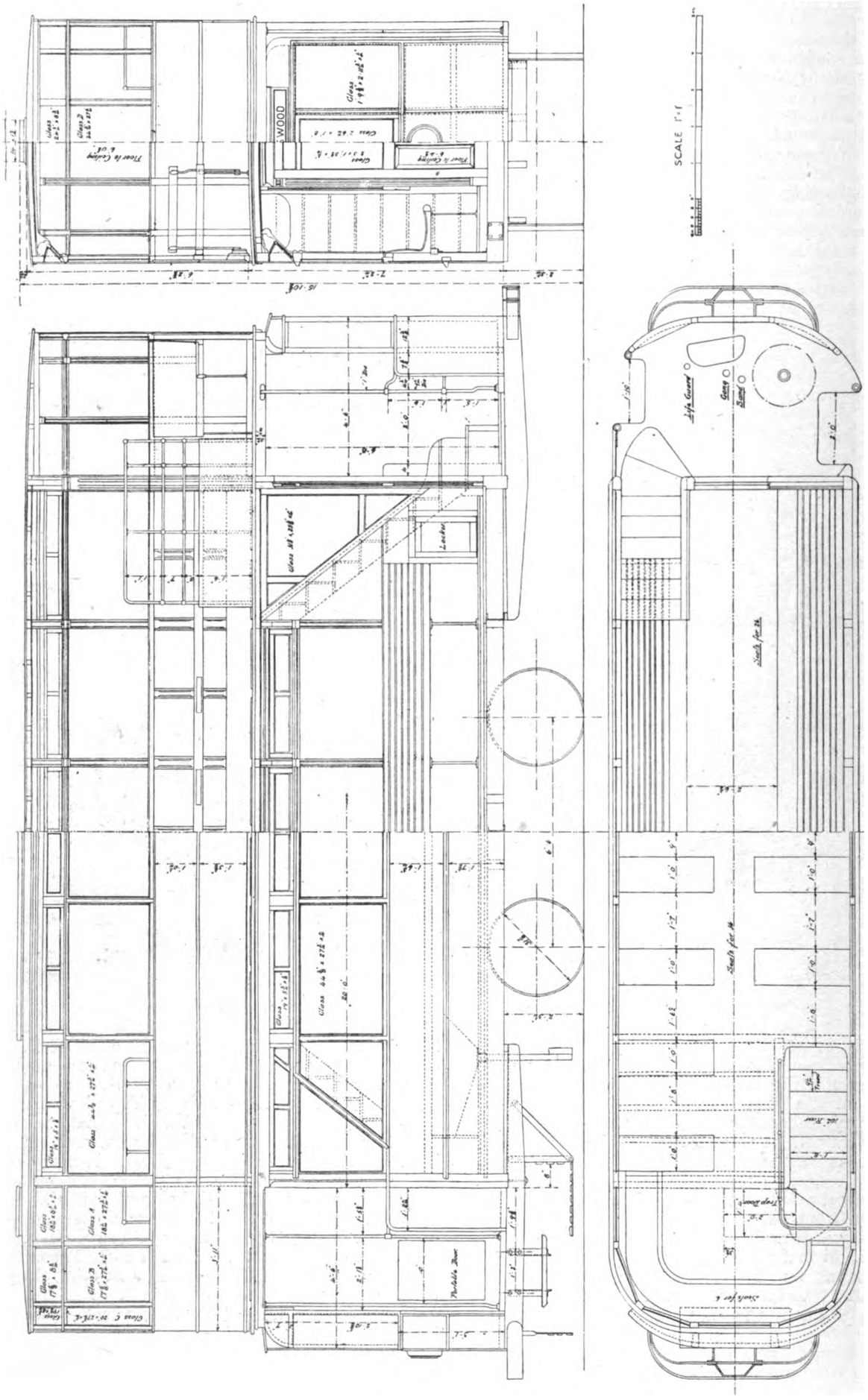


**Plan and Elevation of New Front Exit Car with Enclosed Staircase.—Newcastle Corporation Tramways.**

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Upper Saloon.

Lower Saloon Showing Arrangement of Enclosed Staircase.

IMPROVED CAR AT NEWCASTLE.

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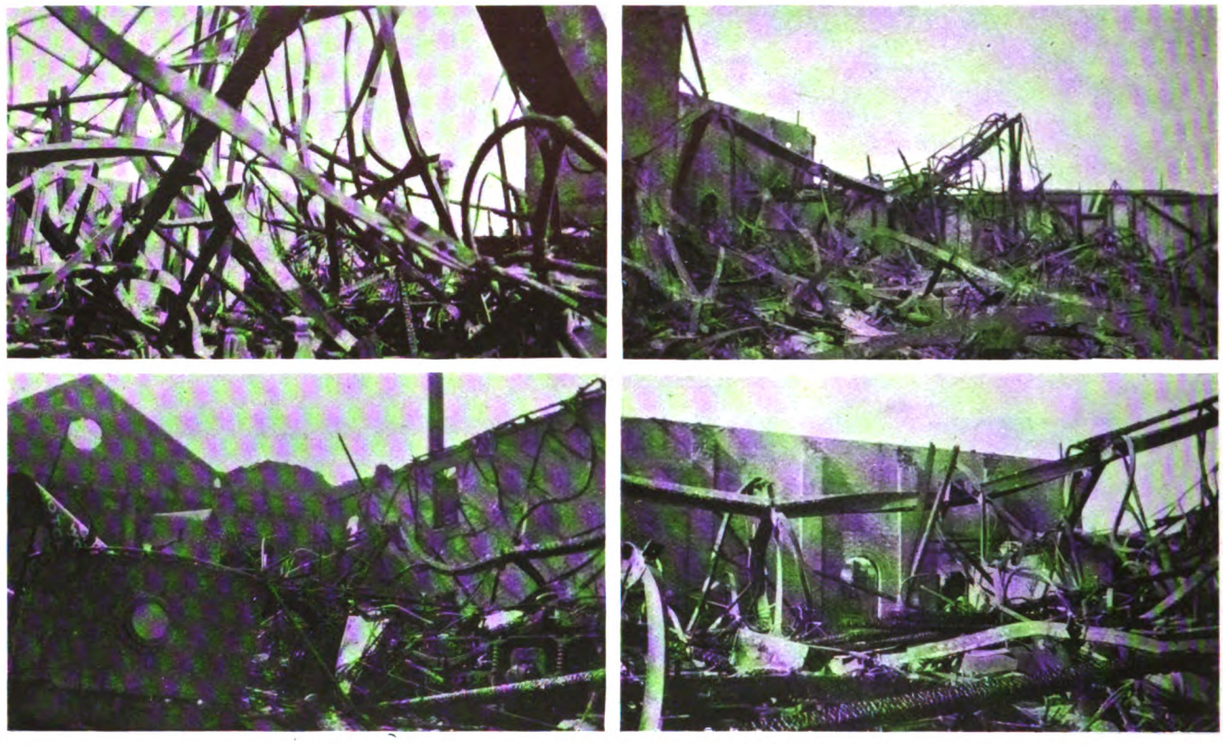
curtailed by the staircases were it not for the fact that this construction enables a longer car body to be provided. This secures greater seating accommodation as compared with a car having a body of the type hitherto constructed. On the lower deck there is a wide gangway of 2 ft. 6 in., which provides ample room for standing passengers, and there are seats for 26 persons.

In the construction of the covered top there are no frames or sliding doors as in the ordinary type of top covered cars. In the Newcastle car the whole of the top deck, as will be seen from the photograph, is entirely open and free from obstruction, thus providing greater simplicity of arrangement, while giving a roomy appearance to the saloon. On the top deck there is seating capacity for 36 passengers. The additional seating capacity here provided under dry conditions in inclement weather, compared with the existing types of top covers in general use, is another feature in this design. The additional revenue to be derived from this arrangement would no doubt quickly repay the cost of the necessary alterations to existing rolling stock, and it also has the great advantage of giving the conductor more freedom of action, leaving more time for the collection of fares—an undoubted gain to any tramway system. There will also be less cost in car maintenance owing to the absence of sliding doors to the top deck compartment. The design and construction of this new type of car are fully covered by letters pat nt.

**The Last Horse Car Disappears from New York.**—The New York daily newspapers a few weeks ago made a good deal of sport over the farewell appearance of the horse car in that city. The last car had been working on a short route in the crowded "down-town" district, and in 1916 only 3,576 passengers purchased tickets, while 1,945 other passengers used the cars with transfer tickets. The total receipts were £35 12s. Last year it cost the New York Railway Company more than 6s. to carry each passenger by these cars, and on July 17, 1917, the total receipts were 5d.

## DARTFORD CARS AND CAR SHED DESTROYED.

The car sheds and cars of the Dartford Tramway Company were destroyed by fire on Tuesday morning, August 7. The fire was first observed about 3 a.m., and although the fire brigade arrived within a few minutes the whole building and its contents were demolished. Of the twelve cars nothing remained but a tangled mass of metal. The origin of the fire is unknown. The night man, who left at midnight, after the last car had been run in, stated that the buildings were then closed and the electric current shut off. Until recently a military guard was stationed at the car sheds, as the cars carry great numbers of munition workers. The Dartford tramways are owned by the Urban Council, which supplies current for the cars, but the undertaking is leased to and worked by Messrs. Balfour, Beatty and Company, under an agreement expiring in 1921.



All that Remained of Twelve Cars and the Car Sheds at Dartford.

Although the whole of the rolling stock (as shown by the accompanying illustrations) was completely destroyed, most of the important books and three days' takings from the tramways were saved.

The company's first concern was the provision of facilities for the large number of munition and other workers in the district. Fortunately the day following was a holiday, which gave he manager, Mr. F. A. Kincaid Fergusson, in conjunction with the manager of the neighbouring system at Bexley Heath, Mr. H. P. Stokes, and Messrs. Vickers, Limited, an opportunity of making the necessary arrangements for providing a service on the Wednesday morning, which service was fully maintained and is now running smoothly. A meeting between Messrs. Balfour, Beatty and Company and the Local Councils of Dartford and Bexley Heath was held, at which it was agreed that for the following month the Dartford undertaking should be operated by the Bexley Heath Council tramway undertaking pending arrangements for the future operation.

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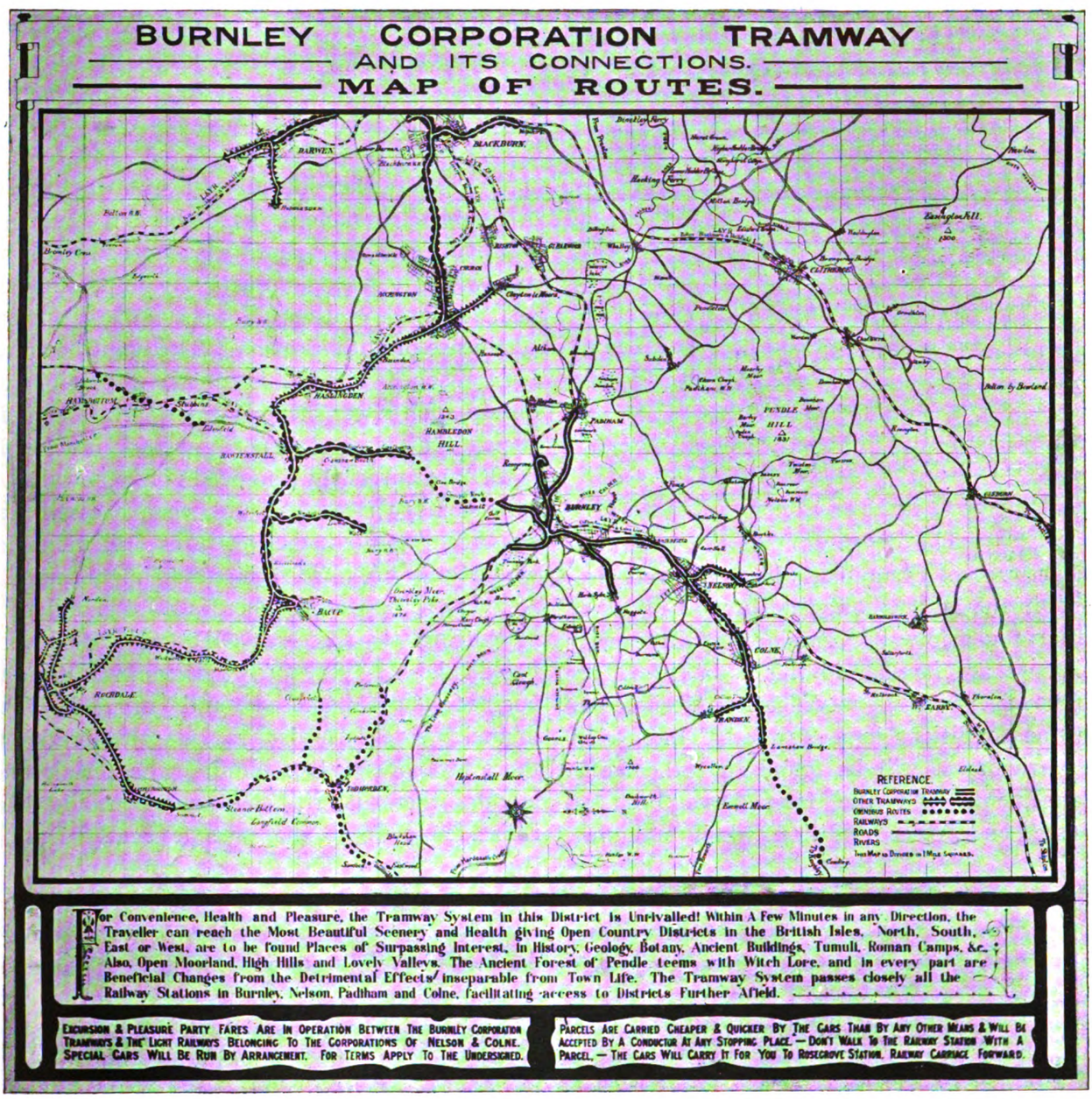
## TRAFFIC DEVELOPMENT AT BURNLEY.

In sending to us the map which is reproduced on this page, Mr. Henry Mozley, general manager of the Burnley Corporation Tramways, writes :—The success of a tramway undertaking from a financial point of view necessarily depends upon the income rather than the expenditure. Whilst there is almost unlimited scope for the development of income, the restriction of expenditure is not so easily controlled, depending as it does upon certain economic laws and municipal policy beyond the control of the expert.

In recent years advertising in different forms has developed, but I wish now to call attention to the advantages of cartoon maps in permanent form now being so commonly used by railway companies, illustrating the railways and their connections, and the facilities which they afford for travelling from place to place. Following on these lines I have caused a map to be prepared showing the Burnley Corporation Tramways and their connections in the immediate vicinity as well as those farther afield. This map has been prepared from official sources, and is to scale, and extends to a district 25 miles square. It has been mounted on a wooden frame, and properly preserved with suitable colours and varnished it should with ordinary care last many years.

The dimensions are 8 ft. 6 in. by 8 ft. 6 in., and unfortunately the map is so large we could not find a suitable place in the centre of the town. It has therefore been erected at the gable end of the old steam depot, about 1½ miles from the centre of Burnley.




Notwithstanding its disadvantageous position it has been the subject of great interest, and has caused a demand for further efforts in this direction. Before long it is hoped to reproduce the map, together with suggested routes for excursion parties, etc., on a card of a suitable size for the pocket.

**London School of Economics.**—For the session of 1917-18 a comprehensive course of lectures has been arranged on railway and cognate subjects. Sir George Gibb will open the session on October 10 with a lecture on the science of transportation. Technics, economics, and finance are all dealt with in the lectures which are to follow.



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THE
# Tramway and Railway World

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LONDON, SEPTEMBER 13, 1917.

**A Far Eastern Tramway.**

The description of the tramways of Shanghai, which is given elsewhere in this issue, shows that broadly speaking the arrangements are similar to those with which we are familiar in this country. There are, however, certain modifications designed to suit the conditions in a crowded Chinese city. In particular it will be found that the traffic arrangements and the fares have been so adjusted as to meet conditions wholly unknown in the West, and that despite the adverse circumstances the undertaking is able to pay good dividends. The Shanghai streets are sometimes narrow, but they are fairly level, and trailer cars are very largely employed without difficulty. The use of the trailer has, in fact, been one of the elements of success, as it has helped to keep down working expenses sufficiently to allow a margin of profit on lines where the receipts per car-mile are small owing to the lowness of the fares. The bulk of the population are too poor to pay what we should call a reasonable fare, and in regard to those who are better off the tramways have to stand the competition of the rickshas. Another element in the success of the undertaking is the fact that it has been found possible to cultivate a large all-day traffic. The depreciation in the value of the native currency has been a source of difficulty, but that, too, has been overcome. We have, in fact, in the Shanghai tramways another tribute to the adaptability of our race. In this case a manager trained on a British tramway has been able in a few years to build up on the other side of the world, and in such a place as Shanghai, a prosperous undertaking in spite of such adverse conditions as are quite unknown except in the far East.

**Track Renewals.**

The difficulty of tramway maintenance has become almost insuperable. The point was reached months ago when it became practically impossible to get new rails without a special Government certificate of authorisation. The point has now been reached when it is almost impossible to obtain such a certificate even where it can be shown that tramways necessary for munitions work are urgently in need of renewal. A further stage is that if and when a certificate has been granted the question still remains, where and when can the rails be obtained? Delivery being secured, there is still the difficulty of getting the necessary labour, skilled and unskilled. At every turn the manager and the engineer are bemused and worried. The financial side has also to be considered. If there is a prospect of obtaining materials and labour, there is still the question of their enormous cost at the present time. During the three years of the war a large mileage of tramway track became due for renewal, and under peace conditions the renewal would doubtless have been carried out. Instead of that, managers have to use every other expedient to prevent the track from going to pieces. The effects on the rolling stock and on the temper of the passengers are alike lamentable. Tramway officers no doubt reflect that things are different in the case of railways. There also difficulties occur in getting new rails, but as the railways are under direct Government control, and are recognised as indispensable for the carrying on of the war, these difficulties tend to be less acute. The same thing applies to a certain extent to the problem of labour, and besides that much less labour is required

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to relay railway track than tramway track. The former, indeed, is a much simpler task from many aspects. There is the further consideration that defective railway track is more apt to lead to serious accidents and loss of life than is defective tramway track. Thus the railways have a stronger plea of absolute necessity. Apart from these things, when one head of a railway rail is worn, comparatively little labour and expense are required to invert it, and at once there is a new running surface. If that has been exhausted, the rail can be lifted, taken into the shops, planed true, and then replaced. Where trains are not excessively frequent the traffic in the interval can all be conducted on the other track past the place where repairs are going on. Joints do not get into a hopeless condition, because they are easy of access and the fishplate bolts are regularly kept screwed up tight. In none of the operations is there any paving to disturb. It appears likely that until supplies of new tramway rails at reasonable prices are available more recourse will have to be had to planing and re-shaping the tramway rail head *in situ*. It is hopeless to think of tearing up the street surface, taking away the rails to the shops, planing them, and then re-laying them. The foundations would be disturbed, the street surface would be open for some time, and in few if any tramway shops would be found planing machines capable of the work. The rail head must be planed and milled and cut to proper shape without disturbing it in its bed. This has already been satisfactorily done in a few towns by a method which was favourably noted in these columns several years ago. Recently some improvements have been made in the machines required, and a demonstration of the process was given a week or two ago at Bolton to representatives from a number of tramways. The value of the invention is now generally acknowledged. Unless, indeed, the rails are hopelessly worn out before the remedy is applied, the process is undoubtedly capable of adding several years to their life.

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**The Special Librarian.** In the United States within the past few years the practice has been considerably developed among important manufacturing and trading companies of forming substantial libraries for the use of their staffs. There can be no doubt of their utility even when they are of modest dimensions. These special libraries are composed of periodicals, pamphlets, books, and reports dealing with the industry or industries in which the company is engaged, and with allied industries. The object is to secure and to have at call a storehouse of information of every kind which has any bearing on the business. There is not very much use of possessing such a storehouse, however, unless there is also a keeper with a key for unlocking it and with such a knowledge of the contents that he can direct the inquirer to the particular items he requires without loss of time, and, so to speak, spread the table ready for him in the shape of all the books and articles bearing on the point in regard to which information is desired. This librarian also has, or ought to have, the task of keeping the library up to date—in these days an almost continuous task. The duties of such a librarian were recently sketched by Mr. M. C. Brush, president of the Boston Elevated Railway Company, in an address delivered before the Special Libraries Association at Louisville. The work and the qualifications of this specialised librarian were placed by Mr. Brush so high that one is inclined to think that an Admirable Crichton would be required if the post was to be properly filled. Yet it is wise to plan largely and even to set the ideal beyond reach. Among other things Mr. Brush said that the employees of a company should feel confident that once the librarian knows their needs he will continue to find matter on the subject until directed to stop, that if new ideas on an old subject come to hand they will be advised of them, and that the librarian should be in fact an assistant both to the staff and the executive. The librarian is to keep himself in a position to be useful by calling on the staff periodically, thus keeping in touch with the work so as to be on the look out for articles in newspapers, periodicals, etc., bearing on the different problems in hand. "The librarian," adds Mr. Bush, "must instinctively know what subjects are bound to come up for discussion at some future time, and accumulate material to aid the executive in the proper study of the question with the least amount of time. The material should not

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consist of stacks of books or pamphlets dumped upon his desk to such an extent that the executive groans at the sight of the job before him, but should consist of specially marked pages or paragraphs in books, reviews, etc., bearing directly on the subject." The librarian should also "demonstrate his ability to advise how various questions have been viewed by different minds, and report why certain schemes were a success or a failure." It is no wonder Mr. Brush concluded his address by suggesting that a more fitting title than that of librarian could be found for the genius who, with ever fresh enterprise, zeal, and industry would carry out the multifarious and exacting duties of the office.

## TRAFFIC CONGESTION IN MANCHESTER.

New Tramway Routes.

The question of the best means for relieving street traffic congestion in Manchester has been before the Corporation for several years. Some considerable time ago the Tramways Committee, the Watch Committee, and the Improvement Committee, acting on instructions, made separate investigations into the subject, and presented reports. The Tramways Committee sent a deputation, including Mr. J. M. McElroy, the general manager, to America and to the Continent of Europe to examine traffic conditions in foreign cities. The Watch Committee also sent representatives to the Continent. After the three reports had been presented the Corporation appointed a Traffic Congestion Special Committee to consider the reports and make final recommendations to the Council.

The Special Committee have presented their report. In this they lay emphasis on the need for new trunk tramway routes and additional tramway termini. They also agree that Parliamentary powers should be obtained to enable the police more effectively to regulate street traffic. In regard to the Tramways Committee's proposal that a tramway terminus should be established on the old Infirmary site in Piccadilly, they say that a widening and lengthening of Parker Street would give all the room needed.

The Special Committee do not bind themselves to details, but give a list of proposed tramway routes :—

No. 1.—A widening of Aytoun Street and a proposed new road in continuation of Aytoun Street to join London Road at its junction with Whitworth Street.

No. 2.—A proposed new road commencing where the above new road crosses Auburn Street, and passing thence to the junction of Chorlton Street and Whitworth Street, and from there behind the School of Technology to Temple Street, along Temple Street and Higher Temple Street to Brunswick Street, and thence along a new road to Stockport Road.

No. 3.—Commencing at Altrincham Street by a junction with Route No. 2, passing along a widened Altrincham Street and Charles Street to York Street, thence along York Street to Rusholme Road, and joining the existing trunk road (Oxford Road).

No. 4.—From City Road along Medlock Street to Stretford Road, thence along a widened Upper Medlock Street to its junction with South Street, and along a proposed new road running in a south-westerly direction to Greenhill Street, crossing that street and passing along a widened Linwood Street, terminating in Bradshaw Street.

No. 5.—Commencing at Whitworth Street West, along Lower Cambridge Street and Higher Cambridge Street to Coupland Street, thence along two new roads to join up with Lloyd Street and Carter Street.

No. 6.—Commencing from Stretford Road, passing along a widened Upper Jackson Street to a widened Boston Street.

The six termini proposed by the Tramways Committee were as follow :—The old Infirmary site, Albert Square, St. Peter's Square, Marsden Square, Cannon Street (Corporation Street), and a re-arrangement of the existing teminus in Stevenson Square. The Special Committee say that, while not committing themselves to details, they are of opinion that these termini are absolutely necessary, not only as a means of meeting the constantly growing demands of the tramway traffic, but also as a means of lessening the general traffic congestion in the central area of the city.

The Committee think that the Royal Infirmary Old Site Special Committee should prepare a scheme for dealing with the site, so that any building erected would be architecturally worthy of such an important situation, and harmonise with gardens and open spaces around.

In regard to certain other proposals made by the Tramways Committee, the Special Committee are satisfied that the proposed new street connecting St. Peter's Square with Albert Square is not essential. As regards the proposal for the widening of Fountain Street, they think that in view of the immense outlay which would be involved in carrying it out the proposal should be abandoned.

The Special Committee express agreement with the view put forward by the Tramways Committee that as the arrangement with the Salford Corporation terminates on May 4, 1924, it is not expedient to make any definite proposals at the present time as regards Deansgate and the provision of a tramway terminus on that side of the city. Negotiations should be opened with the Salford Corporation with a view to coming to some new arrangement as to the future working of the two tramway systems so as to effect improvements in the general interest.

Discussing future requirements, the Special Committee say that steps should be taken to provide additional arterial routes, giving quick and convenient access to the heart of the city. In considering the requirements for passenger transport they had in mind not simply the present form of surface transit—tramways—but the possibility of other forms of passenger transport being developed in the future. It should, however, be clearly understood that, whatever form of surface transit may come along, more street accommodation in the shape of new arterial routes is urgently required.

The congestion caused by the ordinary vehicular traffic in the central parts of the city has been considerably reduced since the outbreak of war, and as the method of traction is undergoing considerable change, it is probable that after the war a large proportion of the merchandise transport formerly dealt with by horse haulage will be dealt with by motor traction, which is more mobile, and tends less to congestion than the slower-going horse traffic. This would have the effect of making the general congestion of all classes of traffic in the heart of the city less acute in the immediate future than it was before the outbreak of war, and if the ordinary vehicular traffic alone, apart from the tramway traffic, had to be considered, it would probably not be necessary to incur any expenditure to meet the difficulties for some years to come.

In closing, the Special Committee point out that it is not suggested that all the proposals should be carried out at the present time, nor yet in the immediate future. Some parts of the scheme are more urgent than others, and these should have priority, but it is important that any portion of the scheme should be considered as only a part of a general plan ultimately to be dealt with.

## REMODELLED RAILS AT BOLTON.

On the invitation of the Woods-Gilbert Rail Grinding and Milling Company, a number of tramway committeemen, managers, engineers, and others interested made an inspection on August 22 of the work now going on in Bolton, under the supervision of Mr. E. Ll. Morgan, borough engineer, remodelling the heads of worn rails by means of the machine with which the company's name is associated. In our issue of August 16 last, particulars of this and of similar work elsewhere were given. Two of the Woods-Gilbert machines are in use in Bolton, removing corrugations, deepening the grooves, and repairing joints. As previously explained, a good deal of the Bolton track is due for renewal. Under war conditions new rails cannot be got, and it is expected that the remodelling of the existing rails will add several years to the life of the track.

The visitors were taken in special cars, provided by the courtesy of the tramway manager, Mr. J. Barnard, to Derby Street and Lostock, where the machines were at work, one being engaged in deepening the groove and the other in grinding the tread. After the demonstration the visitors were entertained to tea, when various speakers briefly expressed much satisfaction with what they had seen, and also their appreciation of the value of the process at a time when tramway authorities were getting into a state of desperation over the subject of track renewal. Councillor Higham, vice-chairman of Blackburn Corporation Tramways Committee, said that but for the machine tramway authorities would have had to take up some part of their tracks to obtain rails to repair other parts. Alderman Lindsay, chairman of the Salford Tramways Committee, and Councillor P. Higson, vice-chairman of the Bolton Tramways Committee, also spoke of the useful work that had been done in various towns. The Woods-Gilbert Company were thanked for having afforded the visitors the opportunity of seeing the machines at work. The company were represented by Messrs. J. Cameron, chairman, J. W. Eunson, engineer, and A. E. Conway, secretary.

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## SERIOUS ACCIDENT AT DOVER.

One of the most serious tramway accidents which has ever occurred in this country took place at Dover on August 12, resulting in eleven people being killed and a large number injured. A Corporation tramcar with about 50 passengers was on its way from Dover to River Village. When it was descending the steep gradient from Crabble Hill to the Athletic Ground, the car got out of control, left the rails, and dashed into a wall at the foot of the hill. The peril to the passengers was intensified by the car overturning after the collision. Some of the top deck passengers were violently thrown off, and all on board were severely cannoned about. Ten passengers were killed on the spot, and among the survivors were some who were very seriously injured. Among the killed were Councillor Joseph, of Folkestone; Mr. Axford, chief clerk of the Dover electricity department; and Miss Lettie Scrace, the conductor of the car. The driver (Brissenden) jumped at the last moment and escaped with minor injuries.

The Dover tramway system, though it possesses a good many gradients, has hitherto been immune from serious accidents. It began operation as long ago as 1897, and was the second municipal electric tramway to be opened in this country, the first being Leeds.

Colonel Pringle held a Board of Trade inquiry into the accident on August 24. The first witness was Mr. Edward Carden, the tramway manager, who said that the River section of the tramways was opened on October 2, 1905. Since then there had not been the slightest trouble on the gradient, which was 1 in 10. The cars were fitted with the ordinary hand brake, electric brake, and the Spencer slipper brake. Under the Board of Trade rules all cars had to stop at the junction of London Road and Crabble Hill. The maximum speed on the hill was to be four miles an hour, and that speed had always been observed. The driver of the car which overturned was taken into service on July 21. He was put under instruction, and he showed that he was exceedingly alert. He had been discharged from the army on June 1 on account of nervous breakdown caused by heat in Egypt. This driver was under instruction for nine days. He first took a car out by himself on August 1 as a regular driver. At the time of the accident he had been driving over the River route for only four days. On the River route the cars were only allowed to carry the number of passengers who could be seated. According to the police, a greater number had been on the car at the time in question. Special instructions had been given that no passenger should stand on the top deck.

E. H. Nye, depot mechanic, testified that the car and brakes were in good order when sent out on the day of the accident. The slipper brake was not used except in case of emergency.

Several passengers testified to the car not stopping at the top of the hill, and described the runaway and the overturn.

W. Knott, a mechanic from the Maxton depot, said he examined the car controller after the accident, and found that the handle was full open for going ahead. There were, however, some children in the car. The slipper brake block looked as if it had been applied.

A. J. Bissenden, the driver of the car, said that he had taken cars down the hill ten times in all when alone and 24 times with others, and he had never found any difficulty. When he got to the top of the hill on the day of the accident he threw off the controller and put on the hand brake, but found that it would not hold. He then tried to put on the slipper brake, but the car was picking up speed so quickly that it would not hold. He tried to get the emergency brake to work, but it would not. As he found he could do nothing else, he jumped off.

The inquiry was closed.

The coroner's inquest was spread over several days. On August 27 the manager said that the tramway service in twenty years had carried 60,000,000 passengers, and that there had never before been a fatal accident to a passenger. On August 29 the jury returned a verdict finding that the accident was due to an error in judgment on the part of the driver, whom they considered was too inexperienced. It appeared that he was an invalided soldier, and had been driving for only a few weeks.

## INCREASE IN LONDON RAILWAY FARES.

On September 1 certain local and through fares were raised on the District, Metropolitan, London Electric, and Central London railways, the Great Northern and City, and the East London lines. No change has taken place in fares where the recent 50 per cent. increase is already effective. In the majority of cases the increase of fares is either a halfpenny or a penny.

On the District Railway the penny fares remain unchanged, except on the section between the Mansion House and Charing Cross, where the new fare will be three-halfpence. On the Hampstead, Bakerloo, and the City and South London railways the local fares will not be changed, but certain increases will apply in the case of journeys involving a transfer.

The necessity for a revision of fares has arisen, it is stated, owing to the increased cost of maintenance and operation charges, which include the payment of a war bonus to the railway workers. It will be remembered that when the Railway Executive Committee raised fares by 50 per cent. the tube railways, which are not under Government control, retained their original fares.

In accordance with the notice given in July, a revision of omnibus fares which then took place in the north-west area has been extended to certain other motor omnibus routes.

## MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL CONFERENCE.

The complete programme of the annual conference of the Municipal Tramways Association, which will be held at Blackpool on September 20 and 21, is as follows:—

THURSDAY, September 20.

10.45 a.m.—Meeting of the Executive Council.

11. 0 a.m.—Presidential address by Mr. Henry Mozley, general manager, Burnley Corporation Tramways.
Paper:—"Notes on Tramway Finance," by Messrs. J. Barnard, general manager, Bolton Corporation Tramways; G. W. Holford, general manager, Salford Corporation Tramways; and P. Priestly, general manager, Oldham Corporation Tramways.
Discussion to be opened by Alderman C. F. Spencer, chairman Halifax Corporation Tramways and Electricity Committee.
Discussion:—"Rule of Footpath." Subject to be introduced by Mr. J. Dalrymple, general manager, Glasgow Corporation Tramways.

1. 0 p.m.—Interval.

2.15 p.m.—Paper:—"Differentiation in Fares for Workmen and Other Passengers on Tramways," by Mr. W. Murray, Assoc.I.E.E., tramways manager, Walthamstow Urban District Council.
Discussion to be opened by Councillor J. Moon, deputy chairman, Plymouth Corporation Tramways Committee.
Discussion:—"Development of Tramways." Subject to be introduced by Mr. Arthur Ellis, M.I.Mech.E., city electrical engineer and tramways manager, Cardiff.

FRIDAY, September 22.

10. 0 a.m.—Meeting of the Executive Council.

10.30 a.m.—Meeting of managers' section.

10.50 a.m.—Extraordinary general meeting to confirm alterations to Articles of Association.

11. 0 a.m.—Annual general meeting.

The headquarters of the association will be at the Savoy Hydro, North Shore, Blackpool, where the meetings will take place.

The officers for the current year are as follows:—

PRESIDENT:
Henry Mozley, Burnley.

VICE-PRESIDENT:
Ald. S. Flint, J.P., Leicester.

PAST PRESIDENTS:
P. Fisher, Dundee; Ald. H. Linsley, J.P., Salford; A. R. Fearnley, Sheffield.

COUNCIL:
A. Baker (past president), Birmingham.
W. Clough, Bury.
Sir J. W. Courtis, J.P., Cardiff.
J. Dalrymple (past president), Glasgow.
A. L. C. Fell (past president), London.
T. B. Goodyer, Croydon.
J. B. Hamilton (past president), Leeds.
Councillor E. Heap, Burnley.
G. W. Holford, Salford.
W. J. McCombe, Hull.
J. M. McElroy (past president), Manchester.
Ald. C. F. Spencer, Halifax.

HON. SOLICITORS:
E. R. Pickmere, Town Clerk, Liverpool.
S. F. James, Town Clerk, Ilkeston.

HON. SECRETARY AND TREASURER (*pro tem.*):
A. R. Fearnley, Sheffield.

**Ipswich Cars to be Painted Grey.**—Mr. Frank Ayton, general manager and engineer of Ipswich Corporation Tramways, informs us that in order to save time and expense in the maintenance of the cars, and also in view of the frequent collisions between cars and other vehicles in the streets, owing to the absence of street lighting, the Corporation have decided that, for the remaining period of the war, the fancy painting of the cars shall be abandoned, and that in place thereof the cars shall be painted two shades of grey with a limited amount of black lining.



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## THE "EVER READY" SANDING GEAR.

Many have been the endeavours in the tramway world to devise a really satisfactory device for sanding the rails. In theory it would appear so simple an operation to convey sand from a receptacle upon the car to the rails, but those who have had any practical experience with the subject know only too well that the matter teems with difficulties. The very nature of sand in its pure state gives it a tendency to clog, a fact which must have been of considerable concern to our forefathers in the design of the hour-glass. When, however, we have to deal with the commercial sand used upon a tramcar, we incur greater difficulties, for we encounter not only sand in varying degrees of fineness and moisture, but also

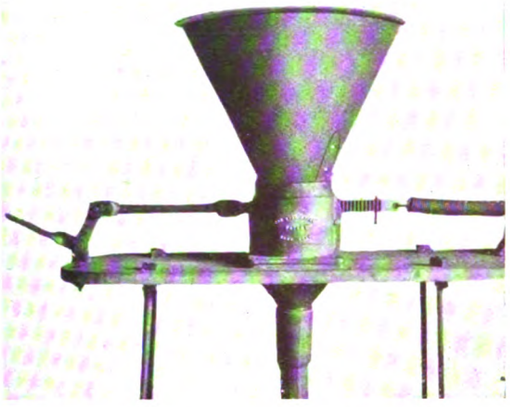

Fig. 1.—Sanding Gear.

containing foreign substances. In addition to this we have another trouble, which occurs at the end of the pipe or duct where the sand emerges before falling on the rail. Owing to its necessarily low position the pipe frequently becomes choked with mud, and on rainy days is subject to a continuous spray of wet from the wheels. The consequence is that when the driver wishes to convey sand to the rails he frequently finds the duct completely obstructed with mud, or an accumulation of wet sand which is only with difficulty removed.

The efficient sanding of the rails is a matter of serious concern, especially upon hilly routes. Any defect in operation may lead to a costly accident. Especially is this fact of great importance at the present time, when many of our drivers are comparatively new to their jobs. The existence of an efficient sanding gear will often give them the confidence which they otherwise lack.

A practical solution for these difficulties is now claimed for a gear recently put upon the market, and known as "Ever Ready." It has been designed by a competent engineer, thoroughly conversant with all the details arising in actual practice.

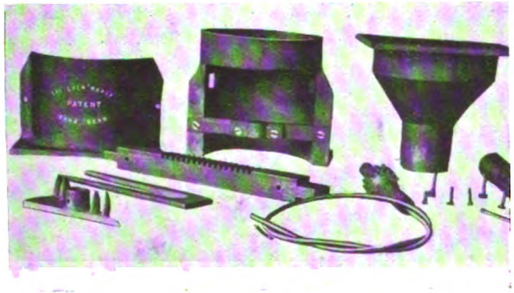

Fig. 2.—Parts of Sanding Gear.

Of the three illustrations accompanying this description, Fig. 1 shows an external view of the apparatus, Fig. 2 a view of the gear unassembled, and Fig. 3 a section of the working parts. The principle of the whole device is to prevent clogging of the sand by providing rotary motion, not only within the hopper carrying the supply of sand, but also throughout the duct, and at the exit orifice especially. To gain this rotary motion from the usual form of pedal gear a rack and pinion are employed. This is best seen in Fig. 2. The body of the gear consists of a circular iron box cast in two halves. This box contains a central vertical spindle carried in two bearings, one being formed in the upper cover of the chamber and the other carried on a cross-bar. The spindle carries a small pinion, which gears into the teeth of a rack carried upon a sliding bar. This bar is provided with draw rods, so that it may be moved from the standard form of pedal gear upon the driving platform. A spring is provided to return the bar after its movement. By this means reciprocating rotary motion is given to the vertical spindle.

The top of the vertical spindle projects into the base of the hopper, and carries a circular plate as shown at the top in Fig. 3. This plate is provided with a series of spikes, so that the rotary motion tends to break up the sand at the base of the hopper, and the plate, having sharp bevelled edges, cuts in pieces any tickets, paper, or bits of waste, etc., that might otherwise obstruct the valve hole, and so enables them to pass through it freely with the sand. Further, this plate forms the valve by covering the hole when the pedal is at rest.

Attached to the lower end of the vertical spindle there is a length of flexible steel cable, which extends throughout the duct leading to the rail. This cable terminates in a fork-shaped piece immediately within the exit orifice, and provides rotary clearing motion at this important point, and so ensures a certain and free exit for sand and other material.

Every contingency of sand clogging has been provided for. The gear is applicable to either single or double truck cars. We understand that the "Ever Ready" gear has already been in trial use for some months upon an important tramway system, where it has fully upheld all the claims put forward by its designer. Those interested in the gear can obtain further particulars from the Equipment and Engineering Company, 2 and 3, Norfolk Street, Strand, London, W.C.2, who are handling the sale of the apparatus.

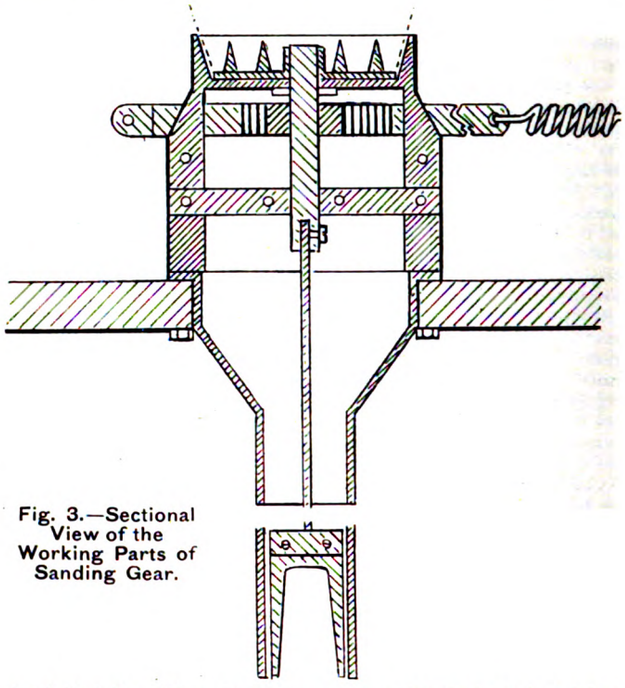

Fig. 3.—Sectional View of the Working Parts of Sanding Gear.

## SHEFFIELD OMNIBUS TRAFFIC.

In the course of a discussion on Mr. Wakelam's paper dealing with extraordinary traffic, at the annual conference of the Institution of Municipal and County Engineers, Mr. W. J. Hadfield, city engineer at Sheffield, said that the paper marked a step forward in the attitude towards the motor omnibus. The author said there should be no attempt made to throttle industry or trade. In Sheffield motor omnibuses were run by the Corporation, and any profits made went to the rates. They were run not as a commercial speculation, but to get people to and from the outlying parts of the city. He did not think large profits were made anywhere outside London. Therefore it was not much use asking the motor omnibus people to make large contributions towards the rates. In the paper they came to much more moderate figures than he had previously seen. At Sheffield, though the petrol consumption was very low, there was not much margin between the total receipts and expenses; certainly nothing to allow of a contribution of 3d. per omnibus mile to the cost of the roads. Mr. Wakelam was of opinion that the steel tires of heavy motor lorries travelling with authorised loads and at regulation speeds were no more destructive to road surfaces than the indiarubber tires. Perhaps the roads mentioned were of macadam or wood, but at Sheffield, where there was a good deal of sett paving, the steel tire was the most destructive. The tire caught the end of the sett and it broke off. Macadam roads on which motor omnibuses had been running for four years, 80 journeys a day, showed no signs of damage. On an undulating road the greatest damage was where the omnibuses got up speed at the bottom level. He had no doubt that was due to the excessive speed at that point. He had water-bound roads and tar-bound roads over which motor omnibuses had run for four years without complaint.

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## GLASGOW TRAMWAYS' PROSPERITY.

The fact that Glasgow Corporation Tramway undertaking is now free of capital indebtedness has attracted the attention of some of the financial and general engineering journals, and much praise is bestowed on the management and direction. Under the heading of "A Record of Success in Municipal Tramways," *Engineering*, devoted a leader to the Glasgow accounts, and to the reasons for the great financial success which has been achieved. In dealing with reasons, the journal points out that there are no tube railways, and the suburban lines of the railway companies are not operated electrically. Moreover, the street paving is not suitable for motor omnibuses; in any case the Corporation have prohibited the working of these. The cab traffic is limited, partly owing to the rate being 1s. per mile. The tramways traverse nearly all the main thoroughfares, and a passenger in the city area need not walk more than 100 or 200 yards to get a car. Apart from these and other things, it is admitted that the fares are commendable. Analysing the favourable traffic receipts, *Engineering* gives the opinion that they are due to the relatively small competitive transport facilities provided. On the other hand, credit is given for the relatively economical working expenses, and the conclusion is that Glasgow has every reason to be proud of the financial condition of the Corporation tramways.

The *Economist*, in dealing more briefly with the matter, adopts a whimsical vein. It says:—"The pathetic attempts of the department to sweat down the amount of its profit which it hands over to what is known as the Common Good are worthy of study. Though the sinking fund amounts to £3,612,838, and equals the total capital expenditure, it is increased by the transfer of £114,378. The depreciation fund receives £34,049 and the permanent way renewals fund £39,255. After paying income-tax and interest on capital (which is balanced by interest received on investments) and various odds and ends, the Common Good is presented with £160,985. We see hard times before the Tramways Committee of the Glasgow Corporation. When the war ends, the payments to dependants of employees cease, and cost of working decreases, all the ingenious financial camouflage of which Scottish administrators are capable will scarcely avail to hide these profits. Yet we would be prepared to back the Tramways Committee to put up a stiff fight to keep them concealed.

## DIVIDENDS.

**Mansfield and District Light Railway.**—An interim dividend of 3 per cent. will be paid on the ordinary shares.

**Fife Tramway, Light and Power Company.**—A dividend of 6 per cent., less tax, will be paid on the preference shares.

**Stewarts and Lloyds, Limited.**—An interim dividend has been declared for the half-year ended June 30 at the rate of 10 per cent.

**Glasgow Subway Railway Company.**—The directors announce an interim dividend at the rate of 2 per cent. per annum on the preference shares.

**Madras Electric Tramways** have declared an interim dividend on the ordinary shares for the half-year ended June 30 at the rate of 8 per cent. per annum.

**Montreal Tramways Company** have announced a further dividend of 2½ per cent., making up the usual distribution of 10 per cent. for the year ended June 30.

**Lanarkshire Tramways Company.**—An interim dividend at the rate of 6½ per cent. per annum, less tax, will be paid on the ordinary shares for the half-year ended June 30.

**Chatham and District Light Railway.**—An interim dividend at the rate of 6 per cent. per annum (6s. per share) has been declared on the ordinary shares for the past half-year.

**Lancashire Dynamo and Motor Company, Limited.**—A dividend of 2½ per cent., free of tax, has been declared, making 12½ per cent. for the year, the same as the rate paid for 1915.

**Para Electric Tramways and Lighting Company, Limited.**—An interim dividend at the rate of 6 per cent. per annum (6s. per share), less tax, will be paid on the ordinary shares for the past half-year.

**Oldham, Ashton and Hyde Electric Tramway Company.**—The directors announce an interim dividend at the rate of 5 per cent. per annum (6d. per share) on the ordinary shares for the past half-year.

**Blackpool and Fleetwood Tramroad Company.**—An interim dividend of 4 per cent. per annum (4s. per share) on the ordinary shares, free of income-tax, has been declared for the half-year. A year ago the dividend was at the same rate.

**Bolckow, Vaughan and Company.**—The directors announce a further dividend of 8½ per cent., less income-tax, making the total return for the year 12 per cent. The corresponding payment a year ago was 8 per cent., and the year's dividend 11 per cent.

**The Workington Iron and Steel Company, Limited,** have declared a dividend for the year ended June 30 last on the ordinary shares of 7 per cent., making 10 per cent. for the year, less tax, and the usual preference dividend. The rates are the same as a year ago.

**Leicester Tramways Committee** have resolved to resume the publication of their weekly traffic returns.

## FINANCIAL REPORTS AND MEETINGS.

**Millars' Timber and Trading Company.**—The profits for 1916 were £48,164, and £50,811 was brought forward. Debenture interest and sinking fund charges absorbed £21,920, and the dividend on the preference shares for the half-year ended June 30, 1916, amounted to £25,500, leaving £36,537, which the directors propose to carry forward.

**Loss on the Accrington Tramways.**—At the monthly meeting of Accrington Town Council, Alderman Higham, alluding to the loss of £976 on the tramways during the past year, pointed out that no one could say what would happen in the future, but the receipts at present were indicative of a deficit during the next twelve months. The Electricity and Tramways Committee were unable to do anything in the way of economising either in the matter of wages or other items, and their only hope was in increased receipts in order to avoid a loss next year.

**Northampton Corporation Tramways.**—The accounts for the year ended March 31 last show that the total revenue was £38,258, compared with £38,076 in the previous year. This is equal to 12·11d. per car-mile, as against 11·7d. The working expenses came to £29,015, (9·16d. per car-mile) compared with £24,130 (7·4d. per car-mile). The increase in working expenses per car-mile are mainly under the heads of general repairs and maintenance, and power expenses. After meeting capital charges and allowing £1,625 for the reserve fund, there is a deficit of £3,004. The passengers numbered 9,707,456, compared with 9,936,774.

**Tyneside Tramways and Tramroads Company.**—The half-yearly report of the directors states that the surplus of receipts over expenses is £7,490, which, with the balance brought forward from last half-year of £664, makes a total to the credit of profit and loss account of £8,154, and after deducting interest on debentures, loans, etc., amounting to £1,012, there remains an available balance of £7,142. This profit the directors propose to appropriate as follows:—In the payment of a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; in the payment of a dividend on the ordinary shares at the rate of 4 per cent. per annum (less income-tax), £2,678; in placing to the credit of reserve for renewals, depreciation, and other contingencies, £1,000; (this, with £576 interest on investments, will increase the fund to £27,413; in placing to the credit of special reserve account, to meet contingencies, £1,000; in setting aside for the reduction of registration and formation expenses, etc., £389; leaving to be carried forward to next half-year, £1,474. The traffic receipts show an increase of £5,539, as compared with the corresponding period of last year.

**Wolverhampton Corporation Tramways.**—Sir Charles Mander presented the Tramways Committee's annual report at a meeting of the Corporation on August 1. The cars, he said, carried 1,700,000 more passengers than in 1916, and 10,000,000 more than in 1904. They took £6,705 more in receipts, but ran 33,000 miles less than in 1914, which was a record; 2·137d. more per car-mile had been earned, showing that the cars were overcrowded. They ought to have more cars, but could neither get the cars nor the men to drive them. The committee had given the equivalent of a 4d. rate to the town. The accounts show a gross profit of £27,538, inclusive of £1,365 from the motor chars-a-bancs. After meeting the statutory charges the following appropriations were made:—Additions and improvements, £234; maintenance and repairs suspense account, £8,183; in aid of borough rate, 1917-18, £6,580; total, £14,997. The sum of £56,645 now stands to the credit of the reserve and renewals fund. The impossibility of obtaining the necessary labour and material to do maintenance and repair work has made it imperative to suspend a large amount of ordinary work. The permanent way in particular needs a great deal of attention, also the electricity mains and telephone cables, and the committee consider it essential to set aside £8,183, which, together with £2,477 brought forward, amounts to £10,660 to meet the cost of this suspended work.

**Birkenhead Corporation Tramways.**—The report of Mr. C. Clarke, tramways manager, for the year ended March 31, 1917, states that the income for the past year forms a new high record, the receipts amounting to £80,747, or £7,927 more than in the previous year. The working expenses were £42,106, leaving a profit on working of £38,641, or £4,654 more than in the preceding year. Interest on capital, sinking fund, and income-tax requires £24,989, leaving a balance of £13,652, an increase of £3,082. This balance has been allocated as follows:—Reserve fund, £5,000; renewals fund, £5,832; in aid of rates, £2,820. The renewals fund has now reached £34,338, and the reserve fund £8,192. Owing to the depletion of the staff and the impossibility of obtaining sufficient labour, Mr. Clarke says that neither the permanent way nor the rolling stock are in the usual satisfactory condition, and it would be impossible to avoid heavy commitments for repair and renewal work after the war. Mr. Clarke accordingly urges the committee to build up the reserve fund to the greatest possible extent, as the conditions brought about by the war have changed all calculations as to depreciation allowances, and what may previously have been a safe figure for tramway depreciation will now have to be increased considerably. The agreement between the tramways and the electricity committees

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regarding the working of the power-station has been revised, and a sliding scale based on the price of coal, water, etc., has been agreed upon.

**Kalgoorlie Electric Tramways.**—At the ordinary meeting of this company in London on August 9, Mr. O. Wethered, who presided, said that the report contained little that was cheering. The period had been one of difficulty and anxiety, and they could not hope for improvement until after the end of the war. The mines, on which the prosperity of Kalgoorlie necessarily depended, were passing through a very trying time. The Chamber of Mines' quarterly statement to June, 1916, showed that there were 1,331 fewer men employed on the mines than for the corresponding period for the year before. The men at Kalgoorlie were demanding higher wages with threats of strikes if their demands were not acceded to. The demands made on this company were such that they could not agree to them. A good many conferences took place, but the men declined the company's offer, and insisted upon their claims being decided by the court. The matter had not yet been dealt with, but there was no doubt that some of their demands would be granted. Unlike other businesses, it was not possible for the company to call on the public to share part of the extra expenses, and although the cost of every article used in the running and upkeep of the tramway might be doubled or trebled, the fares must remain the same, and, whatever the extra cost, the tramways must run according to schedule. The completion of the Trans-continental Railway might favourably affect the situation, but some good discovery of gold in the district would do far more. Meanwhile the directors are doing their best to reduce costs to the lowest figure. The report was adopted.

**Aberdeen Corporation Tramways.**—In his report for the year ended May 31, 1917, Mr. R. S. Pilcher, the general manager, presents very satisfactory results. The total revenue for the year amounted to £100,073, an increase of £5,745, the highest figure yet obtained. Much difficulty has been experienced in coping with the traffic, and at times the whole of the cars have been in service. More cars are required, but there is little hope that these can be obtained until hostilities are over. The working expenses amounted to £64,026, an increase of £5,828, due to the rise in wages and the increased cost of materials. The profit, after payment of interest, sinking fund, and allowances for depreciation and renewals, amounted to £8,763, a decrease of £933 compared with last year. Of this amount the Corporation have carried £5,842 to the reserve account, and contributed £2,921 to the city funds. In spite of the higher cost of operation, the Corporation have not found it necessary to increase the fares. Owing to the scarcity of men, 137 women have been employed—5 as drivers, 118 as conductors, 13 as clerks, and one as an inspector. The total number of employees who have joined the forces is 177, or 69·35 per cent. of the total male staff. The allowances paid to dependants during the year amount to £4,029. The car-mileage was 2,033,793, an increase of 65,178 miles; and the number of passengers carried was 28,623,659, an increase of 2,029,929. The energy consumption per car-mile amounted to 1·251 units, and the cost per unit was ·839d., or 1·050d. per car-mile. The total revenue per car-mile was 11·81d., and the working expenses 7·55d., or 63·98 per cent. of the income.

## CONTRACTS AND ORDERS.

**The J. G. Brill Company** have received an order from Southend Town Council for castings and journal boxes.

**The British Thomson-Houston Company, Limited,** are supplying switchgear for the power-station extension of Rotherham Corporation, at £10,945.

**Sheffield Town Council** have accepted the tender of Dewhurst's Engineering Company, Limited, and of the Stirling Boiler Company, each for 500 steel boiler tubes.

**Rotherham Town Council** have accepted the tender of Babcock and Wilcox, Limited, at £150,500, for six boilers required for the extension of the new power-station.

**Ferranti, Limited,** are to supply four single-phase 2,085-K.V.A. transformers to Rotherham Corporation, and one 250-K.V.A. three-phase transformer to Salford Corporation.

**Johannesburg Municipal Council** have placed orders for copper rail bonds with the Western Electric Company of America, and for the supply of tramcar gear wheels with Hubert Davies and Company.

**The British Westinghouse Electric and Manufacturing Company, Limited,** are the successful tenderers for a 3,000-KW. turbo-generator for Stoke-on-Trent Corporation. The amount of the tender is £18,805.

**Magnetic Brakes.**—The general manager of Sheffield Corporation tramways has sold to Rotherham Corporation five sets of second-hand magnetic brake fittings, taken from the cars recently purchased from the London County Council, at £10 per set.

**Glasgow Corporation** have recommended the acceptance of the following offers:—Traction lamps, Edison and Swan Electric Company and the General Electric Company; steel pinions, A. Wiseman, Limited; gear cases, Equipment and Engineering Company; special track work, Hadfields, Limited.

**Sheffield Electricity Committee** recommend the City Council to accept an offer of the Ministry of Munitions with regard to the transference to Sheffield of a 28,000-KW. plant; to give instructions for the contracts to be placed for the necessary machinery, boilers, etc., at a total cost of £560,000; and to approve the expenditure of £448,000 of the sum named during the current financial year.

**Southend Highways Committee** have recommended the purchase of four electric 2-ton "Orwell" vehicles, with electric tipping bodies and Ironclad Exide batteries from Messrs. Ransomes, Sims and Jefferies, at a cost of £932 each. They have also recommended that application should be made to the Local Government Board for sanction to borrow for a term of five years £4,150 for the purchase of the vehicles, motor generator, and necessary charging plant.

## PERSONAL.

**Mr. W. G. Snell,** tramways manager at Perth, has been granted an increase of £25 per annum in salary.

**Mr. G. H. Lake** has been appointed chief assistant engineer in the electrical department of Derby Town Council.

**Mr. John Barr** has been appointed a director of Vickers, Limited, in succession to Mr. A. Miller, who has resigned.

**Mr. J. A. Lycett,** a member of the Council of the British Electrical Federation, has been appointed a magistrate for Staffordshire.

**Mr. J. Crowther,** electrical engineer, of Wallasey, has been granted an increase in salary from £550 to £650 by annual increments of £25.

**Dundee Town Council** has granted a war bonus of 7½ per cent. on the salaries of the burgh engineer, the water engineer, and the tramways manager.

**Mr. A. C. J. Charlier,** of the Pearlite Steel Company, Limited, Sheffield, has been elected the first president of the National Association of Industrial Chemists.

**Mr. W. E. Riley,** architect of the London County Council, who would have retired in October next under the age limit, will retain his office until October, 1918.

**Mr. R. R. Greene,** tramway manager of Wallasey Corporation Tramways, has been granted an increase in salary from £550 to £650 by four annual instalments of £25 each.

**Mr. A. Hollinworth,** who is at present in the employ of the Huddersfield Corporation, has been offered the post of electricity manager to the Holmfirth Urban District Council.

**Mr. E. Jordon,** of the South Lancashire Tramways Company, has been presented by the engine-room staff with a wristlet watch on the event of his leaving the company to join H.M. Forces.

**Mr. F. H. Rudd** has been recommended by the Rochdale Electricity Committee for appointment as electrical engineer to the Corporation at a salary of £400 per annum, with an increment of £50 within twelve months.

**Messrs. Kincaid, Waller, Manville and Dawson** have removed their offices to 3, Central Buildings, Westminster, S.W.1; St. Stephen's House, their previous address, having been requisitioned by the Government.

**Southend-on-Sea Town Council,** owing to the depletion of their staff, have found it impossible to allow the electrical engineer, Mr. R. Birkett, to serve two days per week for three or four months with the Coal Control Board.

**Mr. John Wardle,** commercial manager of the Metropolitan Railway, has been appointed by Lord Rhondda to control cold storage and inland transport of food. Mr. Wardle studied the methods of the great American meat chilling companies during his visits to the United States. He commenced his railway career with the Lancashire and Yorkshire Railway in Manchester, and during ten years gained a large experience in railway and dock work. He then left Britain to take up a position with the Grand Trunk Railway of Canada. Returning to Britain, he became London traffic manager of the same railway, and in 1908 joined the Metropolitan Railway.

**Mr. E. A. Robert,** president of the Montreal Tramways Company, has been elected a director of the British America Assurance Company and the Western Assurance Company, whose head offices are at Toronto. It is stated that Mr. Robert's appointment is the outcome of a desire of the assurance companies to come into closer touch with large financial and commercial interests in the Province of Quebec. Mr. Robert was appointed a few years ago to the presidency of the Montreal tramways system, and has pursued a policy of extension which has greatly improved the position of the undertaking. The rolling stock has been modernised, and the services greatly improved.

**Portsmouth Salaries.**—Portsmouth Town Council have, on the recommendation of the Tramways Committee, increased the salary of the general manager, Mr. W. R. Spaven, from £500 to £550 per annum, and to £600 in a year's time; and the salary of the engineer, Mr. V. G. Lironi, from £400 to £450 per annum, and to £500 a year hence. Councillor J. Timpson, chairman of the Tramways Committee, who moved the adoption of the proposals, mentioned that

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they were not made on account of the increased cost of living, but as just recognition for extra work well done. Owing to increased traffic extra work and extra responsibility had devolved both on the manager and engineer.

### WITH THE FORCES.

**Mr. W. P. Durtnall** has received a commission as temporary lieutenant in the R.N.V.R. He will be engaged in special electrical engineering and research work.

**Signaller Sergeant F. Hall,** formerly in the employment of the Blackpool, St. Annes and Lytham Tramways Company, is in hospital in France suffering from shrapnel wounds.

**Company-Sergeant-Major R. Edwards,** York and Lancaster Regiment, who was a driver on the Rotherham Corporation tramcars, has been promoted to be Regimental-Sergeant-Major.

**Sergeant S. Davey,** who before joining the colours was a driver on the Rotherham Corporation Tramways, has been promoted to be Company-Sergeant-Major, York and Lancaster Regiment.

**Lieut. E. Ivor David** has been appointed captain in the R.F.C. (Equipment Department). Captain David was formerly manager of the British Thomson-Houston Company in South Wales.

**Corporal James Blackhall,** Cameron Highlanders, who has been awarded the Military Medal for bravery in the field, was, prior to joining the army, in the employment of Glasgow Corporation Tramway Department.

**Bristol Tramways Employee's Medal.**—Mr. Chas. Challenger, manager of the Bristol Tramways and Carriage Company, has sent to us the following :—

Private C. F. Tuplin, of the A.S.C., M.T., was awarded the Military Medal under the following conditions :—He was in charge of a lorry delivering rations to batteries on the night of July 12, at Ypres. He and two men with him were heavily gassed, and the lorry riddled with shrapnel, after having delivered rations to two batteries. Although in this condition he continued the delivery. Returning, still under heavy shell fire, he stopped at the Water Tower, Ypres, and picked up six men, wounded and gassed, bringing them to the casualty clearing station. On arrival at the Park, Private Tuplin and the other two men had to be taken to the hospital. Private Tuplin in civil life was a clerk for many years at Leek Lane carriage-building works of the Bristol Tramways and Carriage Company, and joined the A.S.C. in the early stages of the war.

**Captain James G. Cunliffe,** of the Manchester Regiment, died of wounds on August 1. A short time ago he was awarded the Military Cross for bravery. Captain Cunliffe took the degree of M.Sc. (Tech.) at the Manchester School of Technology, and entered the service of the Manchester Corporation Tramways, becoming assistant electrical engineer. He subsequently occupied a similar position at Birmingham. Captain Cunliffe was joint author with his brother, Mr. R. G. Cunliffe, of various papers read before the Tramways and other associations.

## ORDER OF THE BRITISH EMPIRE.

The first appointments to the Order of the British Empire were announced on August 25. Among those included in the list were the following :—

KNIGHTS GRAND CROSS.

The Right Hon. Sir Eric Geddes, K.C.B., M.P., formerly Inspector-General of Transportation, Headquarter Staff, France. Now First Lord of the Admiralty.

The Hon. Arthur Stanley, C.V.O., C.B., M.P. Chairman of the British Red Cross Society and St. John of Jerusalem in England.

KNIGHTS COMMANDER.

Herbert Austin, Esq., founder of the Austin Motor Company.

Dugald Clerk, Esq., past president of the Institution of Automobile Engineers.

Alfred Edward Herbert, Esq., deputy director-general, Machine Tool Committee.

Lynden Macassey, Esq., K.C., director of Shipyards Labour.

Cecil Partridge, Esq., manager and secretary, Metropolitan Munitions Committee.

Sir Vincent Litchfield Raven, deputy controller (Navy), late acting chief superintendent, Royal Ordnance Factories, Woolwich.

COMMANDERS.

A. Bellamy, Esq., president, National Union of Railwaymen.

William Duddell, Esq., F.R.S., member of the Panel of Board of Invention and Research, Admiralty.

Harry Tempest Vane, Esq., managing director, D. Napier and Sons.

Arthur Watson, Esq., member of the Railway Executive Committee.

OFFICERS.

George Keith Buller Elphinstone, Esq., managing director of Elliott Brothers, electrical instrument makers, Lewisham.

Michael Birt Field, Esq., director, Messrs. Kelvin, Bottomley and Baird, Limited.

Walter Hudson, Esq., assistant secretary, National Union of Railwaymen.

## TRAMWAY AND LIGHT RAILWAY NOTES.

### ASHTON.

NEW LEASE OF THE HURST TRAMWAYS.

At a meeting of the Tramways Committee of the Hurst Council with regard to the proposed new lease of the Hurst tramways, the terms proposed for the new lease of the tramways were stated. Hurst Council is to pay the cost of the renewals, and the Ashton Corporation to carry out the work and to pay the Hurst Council a sum of £60 towards the cost of such renewals. Hurst Council will pay either 5 per cent., or the average rate of interest on the capital expenditure of the undertaking, instead of 3½ per cent. under the present lease.

### BELFAST.

OVERHEAD EQUIPMENT TRANSFERRED TO TRAMWAY DEPARTMENT.

Alderman Tyrrell, chairman of the Belfast Tramways Committee, drew attention at the Council meeting on August 1 to the recommendation that the control and management of the overhead equipment of the tramways be transferred from the electrical engineer to the general manager of the tramways. The committee were unanimous in making the recommendation, believing that the re-arrangement would avoid the overlapping, confusion, and waste which usually results from dual control. The committee were convinced that the change, which was due in no way to any inefficient management on the part of the electrical engineer, would be a good thing for both departments. The proposal was approved by the Council.

### BIRMINGHAM.

EFFORTS TO SUPPLY ENERGY REQUIRED BY THE TRAMWAYS.

Alderman Jephcott, chairman of the Electric Supply Committee, has informed Birmingham Council that while the Government would not sanction the erection of the proposed permanent power-station, the committee were doing their best to prevent any interruption of the tramway services by having the machinery put into the best possible condition, and by not taking more consumers on than they could see their way to supply. The whole of the energy required by the tramways is taken from the Corporation's electricity station, and last winter numerous stoppages and delays were caused by the inability of the station to meet the demands.

### BURNLEY.

CONFERENCE BETWEEN EMPLOYEES AND COMMITTEE.

Recently the Tramways Committee of Burnley Corporation met a deputation from the Tramway and Vehicle Workers' Association with the object of clearing up some points connected with the recent strike. The chief point raised by the representatives of the employees related to the training of learners as drivers and conductors and the part time employment of men of military age who are engaged in other occupations. The employees feared that men eligible for military service might be trained as tramway workers, thereby relieving others of military age already in the tramway service. It was proved, however, that the number of learners was barely sufficient to relieve those men of military age who are likely to be required at an early date. It was explained that the committee were acting in accordance with a resolution of the Town Council of June, 1915, instructing the committees of the Corporation when filling vacancies or engaging employees during the period of the war not to engage anyone eligible for naval or military service. It was also pointed out that the committee were employing discharged soldiers, when suitable, for tramway work. This was in accordance with a resolution of the Council passed in October, 1915, to the effect "that it be an instruction to the committees of the Corporation that employees who have received their discharge from the army or navy disabled be, wherever possible, employed in the department of the Corporation in which they were engaged previous to joining the army or navy." It is stated that the explanation of the committee was satisfactory to the deputation.

### EDINBURGH.

INCREASED EXPENSES ENTAIL HIGHER FARES—TEMPORARY EXEMPTIONS GRANTED EMPLOYEES.

The fares were raised on August 19 last, the 1½d. fare becoming 2d. and the 2½d. fare 3d. Further alterations and increases will probably follow at an early date. The company explain that they have made strenuous efforts in the face of great difficulties to maintain the services and to avoid any increase in fares, but as the Corporation decline to reduce the rent they had no alternative but to increase fares. They point out that the impression that the company had in the past earned large profits was incorrect. The dividends paid since the inception of the company in 1894—i.e., over a period of 23½ years to date—averaged 7·63 per cent., and the total sum paid in dividends represented the sum of £165,875, or only £7,058 per annum, whereas the Corporation had received for rent and owners' rates and taxes and insurance to June 30 last the sum of £1,818,281. The increase is rendered necessary by the enhanced cost of material, increases in wages, the depletion of the car services entailed by so many drivers having been taken by the military authorities, and heavy charges on the company for rent, rates, and taxes. The recent wage increase to employees represented a sum of £12,000 per annum. It is estimated that the



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additional expenditure for the year ending June 30, 1918, as compared with the year 1913, will be about £75,000. An appeal by the Edinburgh and District Tramway Company for the further exemption of 265 of their employees was heard by a local Tribunal on August 7. Mr. Cox, the general manager, stated that every man taken meant a car off the streets. After hearing a number of cases, the Tribunal released one man, a fitter, and granted the others exemption till December 1.

### EXETER.

FORTHCOMING ARBITRATION.

An Industrial Commissioner expects shortly to visit Exeter to arbitrate between the Corporation Tramways Committee and the employees in respect of the application for over 20 per cent. advance in wages. It is stated that the employees have the support of the Trades and Labour Council, representing about 4,000 workers in various trade unions in the city, and the Exeter branch of the National Union of Railwaymen have passed the following resolution:—"That this meeting of the N.U.R., representing 1,000 citizens, protests against the long hours worked by, and low wages paid to, Exeter tramway employees, and calls upon the City Council to give substantial increases of wages upon a basis compatible with the present cost of living."

### HASTINGS.

TROLLEY STANDARD TORN FROM CAR.

An accident of a kind which is fortunately very rare recently occurred on a car of the Hastings Tramways Company. Proceeding from St. Leonards to Bexhill on August 8, the trolley wheel caught in the overhead work, and the trolley standard was torn from the roof of the car and fell into the roadway. Several passengers were injured, one seriously.

### HUDDERSFIELD.

PRIVILEGED PASSENGERS.

In spite of a recommendation to the contrary effect by the Tramways Committee, Huddersfield Town Council have decided to allow the clinical and nursing staffs of its war hospitals to travel free on the cars. Members of the Volunteer Corps can ride at half rates when in uniform going to and from drill. It was stated that the cars were carrying 11,000 wounded soldiers every week. Aberdeen Tramways Committee have agreed to abolish free tokens to nurses and soldiers on military duty, but to fix a maximum fare of ½d. all over for soldiers and sailors in uniform.

### MANCHESTER.

IMPORTANT SCHEME TO RELIEVE CONGESTION.

The Special Committee of Manchester Corporation, who for a long time have been discussing plans for the relief of traffic congestion, have finished their work. Mr. J. M. McElroy, the tramway general manager, who has given much study to the question, was able to lay important considerations before the committee. It is reported that the committee are of opinion that new routes and additional termini are required to meet the growing passenger and merchandise traffic in the centre of the city. The members of the committee suggest the widening of certain streets and the creation of new thoroughfares so as to relieve the tramway traffic on the southern and south-western sides of the city, as well as the east and north-east sides. The idea of converting the site of the old Infirmary in Piccadilly into a network of tramlines has been abandoned. The committee, however, propose that a portion of the site should be used as a tramway terminus. The whole scheme will, it is estimated, involve an expenditure of from £1,000,000 to £1,500,000.

### NEWCASTLE-ON-TYNE.

AIR RAID WARNING FROM TRAMCARS—VOLUNTEER MOTORMEN.

The Newcastle City Council recently approved the plans for the use of the tramway cars as the most effective means of giving warning of air raids. In case of a raid at night, the current will be interrupted and restored after an interval of a minute, so that the driver would know that it was not an accidental failure of the current but intentional, and it will then be finally cut off. In daylight, on receiving the signal—i.e., the cutting off of the current—the motorman will hoist on the front of his car a red flag. The Lord Mayor, making a statement at the Council meeting, said that the scheme was a matter of precaution. They did not want anybody to be "panicky," but they were taking time by the forelock to prepare for any development that the enemy contemplated. The Tramways Committee have released over forty men for the army during this month, their places in the majority of cases having been filled by men of lower categories unfit for military service. About one hundred men, many of whom are said to be well-known professional business men in the city, are now engaged from 5 till 7 o'clock every morning in conveying workers to munition factories, and they also act as auxiliary drivers on Saturday afternoons.

### PETERBOROUGH.

INCREASE IN PRICE OF ENERGY.

The Town Council has decided upon another increase of 10 per cent. in the price of electrical energy as from September 30, making a total addition on the pre-war rate of 20 per cent. Peterborough Electric Traction Company is to be notified that the rates paid by them are to be revised in three months' time.

### SHEFFIELD.

WELFARE WORK—RESULTS OF HALFPENNY FARE ABOLITION.

A writer in the *Sheffield Daily Telegraph* remarks that Sheffield may be justly proud of its staff of women tramway employees. Starting with an experimental dozen, the numbers have now reached six hundred out of a total of just over a thousand. About three hundred wear the star which denotes one year's service. The Corporation pay these women on the principle of equal pay for equal work, and they have also taken special measures to secure the comfort of the employees. Sheffield Tramways Committee were among the first in this country to provide a club and canteen for their men, and an adjacent building has now been fitted up for the women. A staff of about eleven workers manage the clubs, which cost the committee approximately £1,000 a year, or about £1 per employee per annum. As the general manager, Mr. A. R. Fearnley, puts it, "The club isn't a luxury, it's a necessity. We cannot turn one thousand employees loose in the centre of the city for meals and rest." The girls' club has an average attendance of 220 a day. Above the canteen is a large rest-room with a piano. The writer in the *Telegraph* pays a tribute to Mr. Fearnley, "whose broad-minded interest and careful attention to details in the welfare of the tramway employees is," he says, "no doubt largely responsible for the happy conditions which prevail." Sir William Clegg, chairman of the Tramways Committee, has stated that the result of the abolition of the halfpenny fare has so far proved satisfactory. For the four weeks ended July 22, 1916, the receipts were £43,238, as compared with £48,738 for the same period of this year, an increase of £5,500, or over £1,300 per week.

## PATENT LIST.

### Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

### APPLICATIONS FOR LETTERS PATENT.

Wheels for motor vehicles (10,619)—W. Comery and Raleigh Cycle Company.
Motor vehicles (10,781)—A. G. Grice and G. and V. R., Limited.
Chassis and driving mechanism for motor vehicles (10,585)—E. F. Jenkins.
Tramway systems and transporting goods thereon (10,859)—P. Kenyon.
Street railways (10,640)—A. A. Kinney.
Automatic control for vehicles (10,597, 10,599)—A. J. Macy.
Differential devices for road wheels of motor vehicles (10,563)—S. J. Murphy.
Turntables for tramways, etc. (10,763)—Soc. Faure Frères.
Rail fastening (10,762)—J. R. Steele and the Steele Rail Anchor Company.
Adjustable tram-raising apparatus (11,002)—T. J. Bollard and D. J. Jones.
Fluid pressure brakes (10,963)—British Thomson-Houston Company (*General Electric Company*).
Reinforced concrete railway sleepers (11,284)—C. C. Coade.
Gear trains (10,961)—L. M. Douglas and Sir C. A. Parsons.
Lifting jacks (10,937)—F. R. Goddard.
Clutches for motor vehicles, etc. (10,898)—W. Harphan.
Railway sleepers (11,213)—E. A. W. Phillips.
Brake mechanism for vehicles (11,304)—Birmingham and Midland Counties Transport Company.
Self-acting mechanical brake for railway and tramway vehicles (11,586)—T. Grey and T. U. Williams.
Brake mechanism for vehicles (11,304)—G. E. D. Ralls.
Train control (11,439)—P. Torphy.
Steering mechanism of motor-propelled vehicles (11,815)—Alldays and Onions Pneumatic Engineering Company, N. L. Hilton, and C. E Simms.
Motor vehicles (11,604)—J. V. Collyer.
Trolley heads of electric tramways (11,830)—W. H. Cottee and R. H. Hollingsbee.
Solid rubber tire (11,854)—Dunlop Rubber Company and J. V. Worthington.
Road vehicle suspension arrangements (11,704)—W. Greenwood and W. H. Marsden.
Chair for holding rails on railways (11,726)—D. John.
Vehicle direction indicator (11,741)—J. Peyré.
Speed changing and reversing gear (11,712)—G. Pollard.
Wheels for motor vehicles (12,068)—F. E. Baker.
Speed indicating devices for motor vehicles (12,225)—A. A. Benson and Benson, Flick and Solberg.
Railway sleepers (12,062)—T. Brown.
Railway chairs (12,063)—T. Brown.
Motor vehicles (12,096)—Coventry Premier, Limited, and G. Funck.
Trailer gas fuel container for motor vehicles (11,961)—D. S. Cox.
Steering mechanism for motor vehicles (11,913)—W. Ellis.
Electrical point detectors for railways (12,104)—A. E. Hudd and G. H. Wion.

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For Places Abroad—Thirty Shillings per annum.

Motor vehicles (12,064)—O. D. North and Straker-Squire, Limited.
Apparatus for storing coal gas for motor vehicles (12,151)—G. P. Ottino.
Protectors for trollies of electric tramway cars, etc. (11,899)—A. Stevenson.
Automatic brake mechanism (12,006)—E. L. Wetzel.

## Specifications Published.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application numbers should, however, still be used for correspondence purposes.

Combined driving and steering axles for motor road vehicles (9,067—*107,421*)—P. J. F. Batenburg.
Double-deck tramcars and motor omnibuses (9,339—*107,428*)—E. Hatton.
Automatic train control systems (12,352—*105,324*)—W. V. Turner.
Anchorage for tramway rails (15,829—*107,517*)—J. Gordon.
Means for stabilising track of railway permanent way by means of piles (10,010—*107,661*)—F. Fabre.
Solid rubber band tires (13,807—*107,701*)—W. and A. Bates and J. Healey.
Quick-acting combined automatic and straight air brakes (9,704—*107,803*)—W. E. Pomeroy.
Ticket punches (10,245—*107,828*)—E. G. Judd.
Clutch and brake mechanism (15,524—*103,473*)—M. Axilrod.
Motor vehicles (15,604—*107,902*)—H. J. Dew.
Railway vehicles (5,247—*107,989*)—T. F. Craddock (*Burn and Company*).
Life-guards for motor road vehicles (9,940—*108,006*)—S. C. Caddy.
Means for stabilising the track of railway permanent way (10,009—*108,012*)—F. Fabre.
Means for consolidating rail joints (10,012—*108,013*)—F. Fabre.
Transmission gear for motor vehicles (13,804—*108,070*)—C. E. Oliver.
Four-wheel driving devices for motor-propelled vehicles (11,310—*108,216*)—J. L. Ware.
Variable speed transmission gear (11,998—*108,221*)—F. Molyneaux.
Live back axles and gearing for motor vehicles (15,300—*108,251*)—R. R. Mellor and T. M. G. Morton.

1917.

Fastening rails to sleepers (3,705—*107,554*)—E. Hudson and W. S. Hudson.
Rail joints (116—*107,729*)—A. E. Alexander (*Interlocking Rail Joint Corporation*).
Suspension devices for motor vehicles (8,635—*107,750*)—R. Esnault-Pelterie.
Anti-skid and traction devices for vehicle wheels (6,888—*106,496*)—M. H. Cleaver.
Lifting jacks for motor road vehicles (2,828—*108,275*)—F. L. Rapson.
Regenerative braking systems for electrically driven vehicles (2,869—*108,276*)—W. V. Turner and T. H. Thomas.

## Colonial and Foreign Tramways Traffic Returns.

| NAME OF COMPANY. | 1916. WEEKS ENDED. Aug. 5. | Aug. 12. | Aug. 19. | Aug. 26. | | 1917. WEEKS ENDED. Aug. 4. | Aug. 11. | Aug. 18. | Aug. 25. | | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Anglo-Argentine ... ... ... | 49.487 | 48.752 | 48.713 | 48.713 | ... | 52.565 | 51.017 | 50.140 | 49.469 | ... | 34 | 1.738,652 | + 14.596 |
| Auckland ... ... ... ... ... | 21.507 | (28 days) | ... | ... | ... | 21.799 | (28 days) | ... | ... | ... | 4 | 21.799 | + 292 |
| Calcutta ... ... ... Rs. | 72.167 | 69.736 | 70.187 | 66.100 | ... | 69.200 | 68.300 | 70.470 | 69.485 | ... | 34 | 2.305.965 | + 19.447 |
| Madras ... ... ... ... Rs. | ... | (14 days) | 32.269 | ... | ... | ... | (14 days) | 34.911 | ... | ... | 32 | 515.945 | + 46.565 |
| Pernambuco ... ... ... ... | 3.125 | 3.140 | 3.193 | 2.996 | ... | 4.003 | 3.878 | 3.938 | 3.805 | ... | 33 | 126.561 | + 24.999 |

## Companies Issuing Monthly Statements.

| | 1916. March. | April. | May. | June. | July. | August. | 1917. March. | April. | May. | June. | July. | August. | Wks. | AGGREGATE. 1916-17. | + or −. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Ballarat & Bendigo .. | 3.881 | 3.727 | 3.854 | 2,794 | ... | ... | 3.422 | 4.611 | 2.991 | 2.849 | ... | ... | 12 | 10.451 | + 76 |
| Brazilian Traction Mlrs | 6913000 | 6882000 | 7304000 | 7178000 | ... | ... | 7549000 | 7453000 | 7864000 | 7642000 | ... | ... | 26 | 44.646.000 | + 3.467.000 |
| Brisbane ... ... ... | 34,275 | 32.575 | 33.150 | 31.390 | 32.880 | ... | 33.340 | 31,620 | 33,340 | 32,475 | 32.720 | ... | 30 | 226.315 | − 915 |
| British Columbia $ | 446.401 | 421,265 | 414,215 | 400.814 | 411.847 | ... | 456,626 | 447.429 | 438.919 | 373.029 | 438.378 | ... | 4 | 438.378 | + 26.531 |
| Buenos Ayres Lacroze | 42.219 | 40,220 | 40,220 | 36.213 | 38.439 | 36,431 | 41,337 | 39.111 | 40,595 | 38.020 | 38.063 | 39,111 | 8 | 77.174 | + 2,304 |
| Burma ... ... ... | 22.958 | 22,191 | 23.585 | 24.027 | 26,340 | ... | 27.132 | 23,660 | 24.906 | 25.463 | 26.288 | ... | 52 | 309.167 | + 29,082 |
| Cape Town ... ... | 14,994 | ... | ... | ... | ... | ... | 17.688 | 16.705 | 15.867 | ... | 16.067 | ... | — | — | — |
| Carthagena & Herrerias | 2.991 | 2.513 | 2.927 | 3.512 | 2.371 | 2,081 | 2.955 | 4.366 | 4.321 | 5,325 | 5.763 | 4,164 | 34 | 34,099 | + 13,278 |
| Cordoba ... .. ... | 13.598 | ... | 14.869 | ... | ... | ... | 13,098 | ... | 13.735 | ... | ... | ... | 9 | 27.395 | − 1,546 |
| East India ... ... | 2.196 | 2.116 | 2.161 | 2.283 | 2.220 | ... | 1.647 | 1.445 | 1.455 | 1.186 | 1.183 | ... | 52 | 21.509 | − 3.861 |
| Kalgoorlie ... ... | 2.479 | 2.553 | 2.921 | ... | ... | ... | 2.772 | 2.705 | 2.692 | ... | ... | ... | 21 | 12.793 | + 356 |
| La Plata ... .. ... | 4.611 | 4.354 | 4,342 | 3.735 | 3.910 | ... | 4,527 | 4.229 | 4.126 | 3.852 | 3.875 | ... | 30 | 29.019 | − 816 |
| Lima ... ... ... | 34.169 | 33.542 | 33.966 | ... | ... | ... | 37.569 | 37.807 | 35.321 | ... | ... | ... | 21 | 181.809 | + 13,098 |
| Manaos ... ... Rs. | ... | 155.030 | 152.854 | 144.913 | 152.380 | ... | 161.156 | 160.545 | 158.613 | ... | ... | ... | — | — | — |
| Manila ... ... $ | ... | ... | 53.900 | ... | ... | ... | ... | ... | 61.500 | ... | ... | ... | — | — | — |
| Mexico ... ... $ | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Monte Video ... ... | 31.956 | 28.997 | 28.349 | 25.300 | 25.220 | ... | 31.979 | 29.230 | 28.716 | 27,458 | 28.597 | ... | 39 | 271.393 | + 5,105 |
| Peruvian ... ... $ | ... | ... | 826.900 | 929.500 | 835.430 | ... | ... | ... | 902.780 | 965.420 | 975.000 | ... | 4 | 975.000 | + 139.570 |
| Port Elizabeth ... ... | ... | ... | ... | ... | ... | ... | 4,428 | 3,904 | 3.494 | ... | 3.544 | ... | — | — | — |
| Rangoon ... ... ... | 5.501 | 4.849 | 4.589 | 4.205 | 4.357 | ... | 6.226 | 5,036 | 4.737 | 4.383 | 4.783 | ... | 30 | 34.403 | + 1.465 |
| Toronto ... ... $ | 910.969 | 883.209 | 903.924 | 884.491 | 867.789 | ... | ... | 979.367 | 992.460 | 984.529 | 954.192 | ... | 30 | 6,827,776 | + 624.788 |
| Winnipeg ... $ | 296.500 | 282.498 | 276.980 | 254.686 | 242.688 | ... | 293.094 | 265,594 | 259.794 | 254,226 | 242.797 | ... | 30 | 1.916.167 | − 27.995 |

(*Continued on page 180*)

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# TRAFFIC RETURNS—*continued.*

## Tramways and Omnibus Undertakings in the United Kingdom.

| NAME OF COMPANY OR CORPORATION. | 1916. WEEKS ENDED. Aug. 5. | Aug. 12. | Aug. 19. | Aug. 26. | 1917. WEEKS ENDED. Aug. 4. | Aug. 11. | Aug. 18. | Aug. 25. | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Aberdare U.D. Council | 420 | 525 | 411 | 445 | 445 | 584 | 476 | 456 | 20 | 9.006 | + 883 |
| Aberdeen Corporation | 2.074 | 2.232 | 2.092 | 1.987 | 2.237 | 2.205 | 2.323 | 2.251 | 12 | 26.984 | + 3.403 |
| Accrington Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ayr Corporation | 683 | 773 | 681 | 1.003 | 688 | 724 | 814 | 619 | 15 | 9.242 | + 1.032 |
| Bath Electric | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Belfast City | 6.036 | 6.160 | 5.374 | 5.626 | 6.361 | 6.633 | 6.410 | 6.392 | 21 | 129.932 | + 11.394 |
| Birkenhead Corporation | 1.663 | 1.700 | 1.642 | 1.613 | 1.935 | 2.155 | 1.961 | 1.824 | 21½ | 38.423 | + 5.474 |
| Birmingham Corporation | 17.029 | 17.390 | 16.643 | 16,900 | 18.032 | 18.249 | 18.103 | 18.743 | 21 | 375.500 | + 26.030 |
| Birmingham Corp. Motor Omnibuses | 1.187 | 1.405 | 1.089 | 1.068 | 961 | 1.451 | 1.150 | 1,177 | 21 | 20.378 | — 896 |
| Blackburn Corporation | 1.347 | 1.391 | 1.358 | 1.335 | 1.738 | 1.641 | 1.771 | 1.568 | 17⅔ | 32.863 | + 4.783 |
| Blackpool and Fleetwood | 2.002 | 2.652 | 2.678 | 2.373 | 2.038 | 2.672 | 2.603 | 2.188 | 33 | 28.863 | — 90 |
| Blackpool Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bolton Corporation | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bournemouth Corporation | 3.303 | 3.350 | 3.288 | 2.969 | 3.766 | 3.757 | 3.862 | 3.149 | 21½ | 56.049 | + 2.674 |
| Bradford Corporation | 7.355 | 7.294 | 7.923 | 8.017 | 7.653 | 8.608 | 8.924 | 8.084 | 21 | 163 247 | + 15.002 |
| Brighton Corporation | 1.817 | 2.093 | 1.942 | ... | 1.866 | 2.561 | 2.216 | ... | 20½ | 30.826 | — 4.084 |
| Bristol | 5.603 | 6.308 | 5.171 | 5.358 | 5.955 | 7.549 | 5.915 | 6.330 | 33 | 180.895 | + 15.724 |
| Burnley Corporation | 1.797 | 1.739 | 1.769 | 1.702 | 1.930 | 1.934 | 1.863 | 1.835 | — | — | — |
| Burton-on-Trent Corporation | 301 | 324 | 322 | 319 | 342 | 396 | 334 | 331 | 21 | 71.655 | + 539 |
| Bury Corporation | 1.561 | 1.561 | 1.558 | 1.564 | 1.720 | 1.836 | 2.041 | 1.806 | 21½ | 36.137 | + 4.368 |
| Cardiff Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Chatham and District | 1.528 | 1.669 | 1.469 | 1.498 | 1.359 | 1.841 | 1.611 | 1.507 | 23 | 43.790 | + 2.680 |
| Chesterfield Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Colne Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Cork Electric | 643 | 651 | 557 | 580 | 674 | 679 | 621 | 595 | 34 | 18.314 | + 1.136 |
| Croydon Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Derby Corporation | 1.281 | 1.347 | 1.282 | 1.287 | 1.260 | 1.561 | 1.319 | 1.284 | 21 | 25.382 | + 696 |
| Dover Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin and Lucan | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin United | 7.516 | 7.820 | 7.017 | 7.074 | 7.572 | 8.458 | 7.242 | 7.099 | 34 | 224.955 | + 23.068 |
| Dundee City | 1.523 | 1.573 | 1.492 | 1.492 | 1.592 | 1.489 | 1.498 | 1.573 | 14½ | 22.056 | + 1.853 |
| East Ham Corporation | 1.476 | 1.450 | 1.373 | 1.416 | 1.405 | 1.599 | 1.482 | 1.508 | 21 | 30.313 | + 2.003 |
| Exeter Corporation | 499 | 512 | 485 | 475 | 469 | 538 | 456 | 456 | 21 | 8.623 | + 17 |
| Gearless Motor 'Buses | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Glasgow Corporation | 23.931 | 24.110 | 23.638 | 20.766 | 26.029 | 26.142 | 25.902 | 25.907 | 12⅔ | 322.707 | + 36.741 |
| Glossop (Urban Elec. Supply Co.) | 152 | 154 | 154 | 143 | ... | ... | 176 | 176 | 34 | 5.009 | + 360 |
| Halifax Corporation | 2.551 | 2.647 | 2.875 | 2.753 | 2.580 | 2.897 | 3.418 | 3.165 | 20⅔ | 52.925 | + 4.174 |
| Halifax Corp. Motor Omnibuses | 59 | 59 | 72 | 63 | 53 | 54 | 69 | 68 | 20⅔ | 972 | — 73 |
| Hastings and District | 1.623 | 2.082 | 1.930 | 1.908 | 1.600 | 2.381 | 2.069 | 2.019 | 34 | 40.973 | + 6.193 |
| Huddersfield Corporation | 3.247 | 3.357 | 3.387 | 3.047 | 3.269 | 3.849 | 3.784 | 3.385 | 21 | 69.816 | + 6.008 |
| Hull Corporation | 3.202 | 3.444 | 3.286 | 3.157 | 3.517 | 3.828 | 3.530 | 3.478 | 21 | 71.161 | + 4.301 |
| Ilford U.D. Council | 787 | 798 | ... | ... | 791 | 1.034 | ... | ... | 19 | 14.773 | + 1.304 |
| Ilkeston Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ipswich Corporation | 621 | 675 | 614 | 597 | 798 | 1.127 | 845 | 865 | 21 | 14.687 | + 2.817 |
| Isle of Thanet | 791 | 1.023 | 1.002 | 987 | 347 | 713 | 574 | 601 | 47 | 14.477 | — 2.178 |
| Kilmarnock Corporation | 192 | 180 | 188 | 188 | 184 | 188 | 194 | 195 | 14½ | 2.838 | + 198 |
| Lanarkshire | 2.481 | 2.773 | 2.593 | 2.631 | 2.865 | 3.042 | 2.965 | 2.963 | 34 | 91.750 | + 14.151 |
| Lancashire United | 2.061 | 2.328 | 2.052 | 2.036 | 2.624 | 3.929 | 2.902 | 2.805 | 34 | 77.166 | + 16.678 |
| Leeds City | 10.625 | 11.232 | 10.491 | 10.612 | 10.719 | 12.579 | 11.312 | 11 549 | 21 | 233.385 | + 23.404 |
| Leicester Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Leith Corporation | 992 | 999 | 939 | 900 | 1.099 | 1.106 | 1.084 | 1.033 | 14½ | 16.056 | + 2.796 |
| Leyton U.D. Council | 1.999 | 2.121 | 1.869 | 1.904 | 1.917 | 2.270 | 1.981 | 2.026 | 21 | 40.629 | — 4.359 |
| Liverpool Corporation | 15,726 | 16.286 | 15.204 | 15.107 | 16.564 | 18.295 | 16.657 | 16,289 | 33⅔ | 519.321 | + 44,227 |
| Llandudno and Colwyn Bay | 643 | 966 | 878 | 884 | 628 | 982 | 836 | 836 | 38½ | 12.521 | — 789 |
| London County Council | 52.598 | 52.079 | 49.775 | 49.848 | 55.757 | 61.545 | 57.592 | 58.527 | 20½ | 1.146.260 | + 143.669 |
| London General Omnibus | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| London United | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Lowestoft Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Maidstone Corporation | 256 | 261 | 249 | 242 | 239 | 346 | 280 | 277 | 21 | 5.182 | + 488 |
| Manchester Corporation | 19.635 | 20.065 | 19.235 | 19.575 | 20.082 | 22.410 | 20.700 | 21.463 | 21 | 431.335 | + 29.240 |
| Metropolitan Electric Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| National Steam Car | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Nelson Corporation | 232 | 225 | 224 | 214 | 236 | 262 | 235 | 230 | 21 | 4.954 | + 316 |
| Newcastle-on-Tyne Corporation | 7.322 | 7.055 | 7.012 | 7.030 | 7.970 | 8.388 | 7.860 | 8.042 | 21 | 162.746 | + 23.046 |
| Newport (Mon.) Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| New St. Helens and District | 1.260 | 1.661 | 1.369 | 1.195 | 1.569 | 2.465 | 1.750 | 1.656 | 8 | 13.508 | + 3.915 |
| Northampton Corporation | 785 | 928 | 758 | 762 | 857 | 1.167 | 852 | 884 | 21 | 17.296 | + 2.190 |
| Nottingham Corporation | 4.187 | 4.444 | 4.158 | 4.213 | 4.420 | 5.574 | 4.551 | 4.619 | 21 | 90.829 | + 8.564 |
| Oldham Corporation | 2.726 | 2.614 | 2.529 | 2.788 | 2.972 | 3.055 | 2.906 | 3.286 | 22 | 63.190 | + 6.423 |
| Portsmouth Corporation | 3.644 | 3.807 | 3.422 | 3.592 | 3.041 | 4.359 | 3.807 | 3.834 | — | — | — |
| Preston Corporation | 1.120 | 1.120 | 1.258 | 1.177 | 1.190 | 1.246 | 1.356 | 1.257 | 20½ | 24.597 | + 1.676 |
| Provincial | 3.092 | 3.309 | 2.989 | 3.012 | 2.679 | 3.870 | 2.173 | 3.211 | 47 | 107.758 | + 1.165 |
| Reading Corporation | 978 | 1.000 | 945 | 991 | 1.058 | 1.338 | 1.192 | 1.182 | 20⅔ | 21.524 | + 3.677 |
| Rhondda Tramways | 837 | 1.519 | 1.358 | 1.456 | 832 | 2.104 | 1.612 | 1.532 | 34 | 49.823 | + 7.168 |
| Rochdale Corporation | 1.927 | ... | ... | ... | 2.373 | ... | ... | ... | 18 | 38.283 | + 4.656 |
| Rotherham Corporation | 1.748 | 1.705 | 1.764 | 1.740 | 1.946 | 1.931 | 1.923 | 1.864 | 21½ | 38.439 | + 5.577 |
| Salford Corporation | 6.089 | 5.818 | 5.603 | 5.660 | 8.748 | 6.814 | 6.692 | 6.584 | 21⅔ | 141.846 | + 21.988 |
| Sheffield Corporation | 10.782 | 11.177 | 10.825 | 11.150 | 11.717 | 12.902 | 12.290 | 12.468 | 22 | 260.804 | + 28.766 |
| Southampton Corporation | 1.935 | 1.986 | 1.939 | 1.969 | 1.975 | 2.498 | 2.277 | 2.294 | 20½ | 41.040 | + 6.161 |
| Southend-on-Sea Corporation | 1.430 | ... | ... | ... | 1.152 | ... | ... | ... | 18 | 16.939 | + 1.157 |
| South Metropolitan Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| South Shields Corporation | 1.012 | 1.019 | 932 | 688 | 960 | 1.231 | 1.032 | ... | 20 | 19.206 | + 2.318 |
| Sunderland Corporation | 1.939 | 2.003 | 1.789 | 1.729 | 1.893 | 2.346 | 1.924 | 1.915 | 21 | 38.522 | + 2.146 |
| Sunderland District | 831 | 834 | 751 | 716 | 786 | 1.205 | 900 | 850 | 43 | 30.372 | + 4.380 |
| Swindon Corporation | 216 | 236 | 235 | 242 | ... | 337 | 315 | 304 | 20½ | 5.651 | + 1.416 |
| Torquay Tramways | 1.413 | 1.050 | 1.018 | 1.132 | 1.536 | 1.195 | 1.105 | 1.065 | 34 | 20.923 | + 1.459 |
| Tramways (M.E.T.) Omnibus Co. | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Tyneside Tramways and Tramroads | 807 | 867 | 788 | 688 | 918 | 1.267 | 937 | 1.011 | 8 | 7.718 | + 1.855 |
| Wallasey Corporation | 1.760 | 2.005 | 1.768 | 1.719 | 1.926 | 2.496 | 2.003 | 1.981 | 21½ | 35.058 | + 4.062 |
| Walsall Corporation | 871 | 1.050 | 885 | 928 | 968 | 1.436 | 965 | 1.055 | 21 | 20.350 | + 2.302 |
| Walthamstow U.D. Council | 1.462 | 1.584 | ... | ... | 1.216 | 1.686 | ... | ... | 19 | 24.417 | + 2.672 |
| Warrington Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| West Ham Corporation | 3.571 | 3.567 | 3.329 | 3.375 | 3.701 | 4.178 | 3.779 | 3.835 | 20⅔ | 77.584 | + 8.461 |
| Wigan Corporation | 1.702 | 1.996 | 1.666 | 1.677 | 1.961 | 2.425 | 2.005 | 1.997 | 20 | 40.765 | + 5.342 |
| Wolverhampton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Yorkshire (West Riding) | 2.090 | 2.192 | 1.903 | 1.983 | 2.348 | 3.186 | 2.373 | 2.302 | 34 | 70.974 | + 11.682 |

### * TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

### TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.


### THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates:

For the United Kingdom—
Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).

For Places Abroad—
Thirty Shillings per annum.

Tel. No.: **2948** Gerrard.
Telegraphic Address: **"Tramigro," London.**

**Amberley House, Norfolk St., W.C.**


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# MANCHESTER confirms SHEFFIELD

## *The Manchester Corporation also obtains remarkably low Maintenance Costs by employing DAIMLER COMMERCIAL CHASSIS only*

FOLLOWING on the published statement of the Sheffield Corporation's Motor Omnibus Running Costs, the following records from Manchester again emphasise the fact that for low Maintenance Costs the Daimler is supreme.

PROSPECTIVE users of Commercial Vehicles will do well to carefully note these records, for these Corporations are not unduly influenced by the question of Prime Cost, but base their calculations on the broad lines of efficiency and profitable investment.

Per Bus Mile.

| Year ending March 31st. | Mileage Run. | Average Cost. | Average Revenue. | Repairs and Maintenance. |
|---|---|---|---|---|
| 1915 | 160,775 | 7·36d. | 9·24d. | |
| 1916 | 82,711 | 7·17d. | 11·84d. | 1·68d. |
| 1917 | 180,956 | 8·04d. | 9·67d. | 1·20d. |

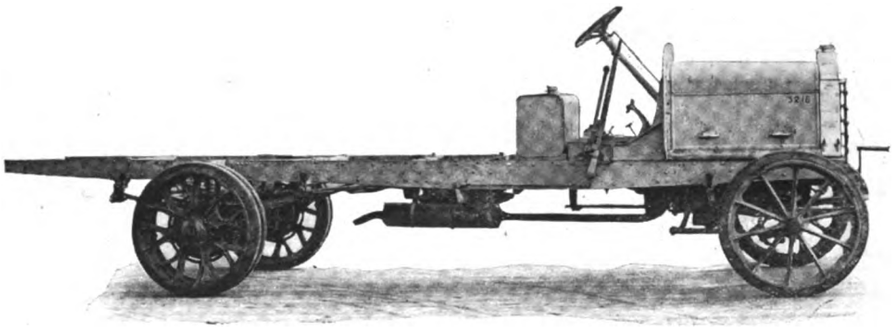
IN the above figures for Repairs and Maintenance the actual cost of *Chassis* Maintenance apart from Tyres, Bodies, Buildings, and Machinery is extraordinary, being at the low figure for 1917 of **·727d.**, a DECREASE on the previous year of ·56d. per bus mile.

The Daimler Way is the sure and certain way to Profits.

**Daimler**

The Daimler Sleeve-valve Engine is the only Engine which improves with age.

THE DAIMLER COMPANY, Ltd., COVENTRY.





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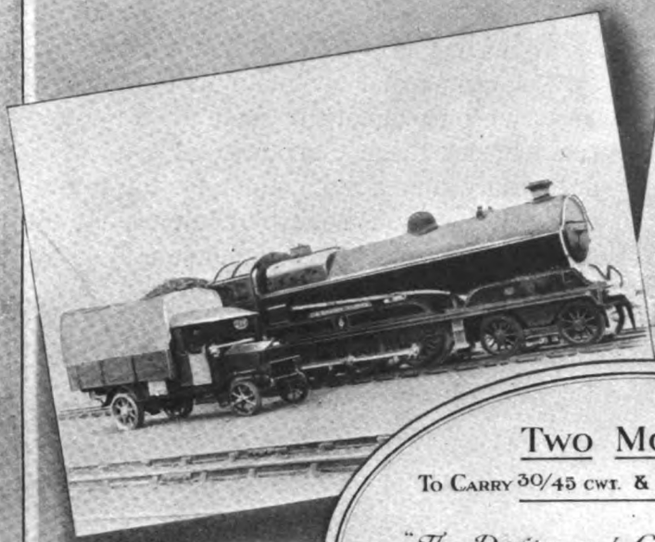
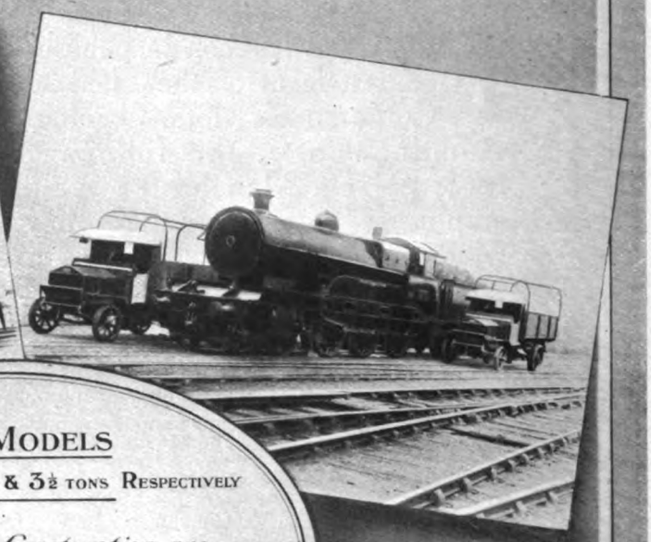
# NAPIER

## MOTOR VEHICLES.





TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

*"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."*

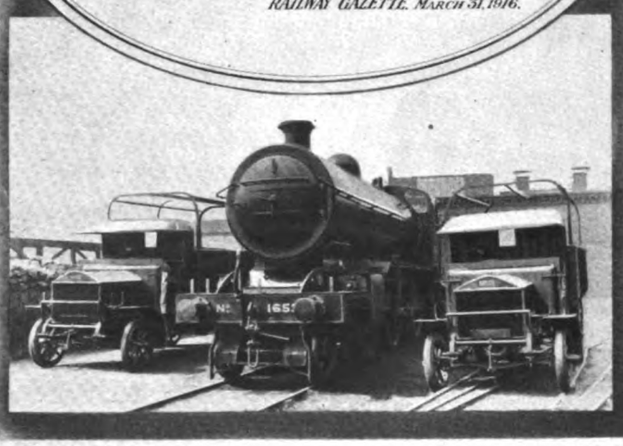
*RAILWAY GAZETTE, MARCH 31, 1916.*

**IN PEACE**

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

**IN WAR**

USED BY THE BRITISH AND ALLIED GOVERNMENTS.



# D·NAPIER & SON LTD.

WORKS
ACTON, LONDON. W

14, NEW BURLINGTON ST. LONDON. W.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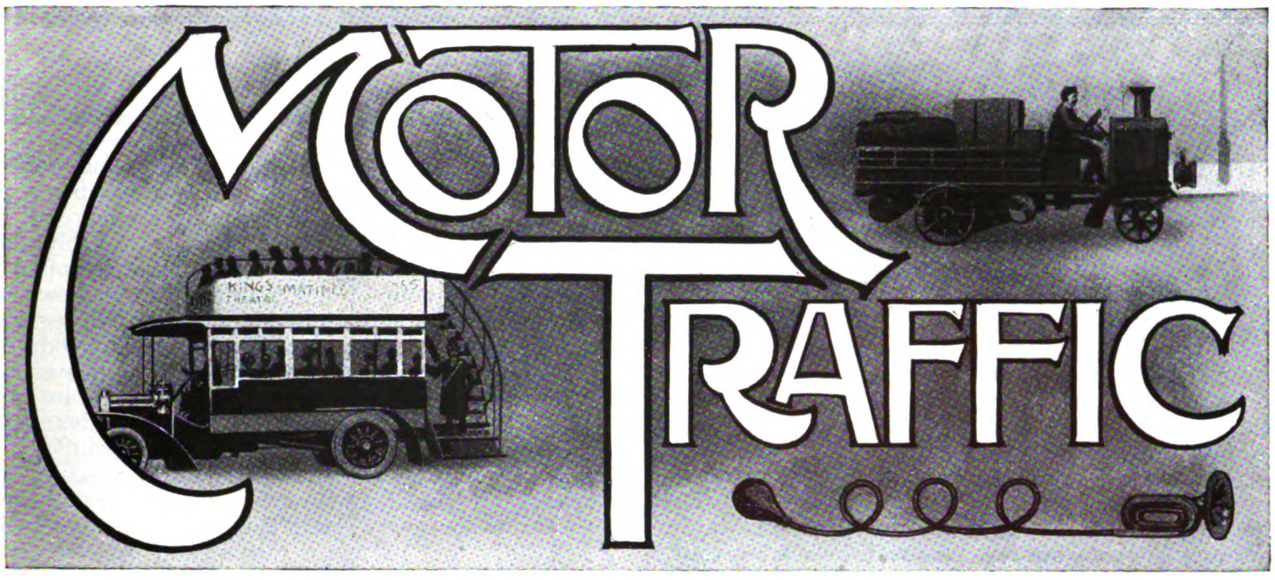


The accounts of various municipal motor omnibus undertakings published this summer have naturally shown an all-round increase in working costs. The most noticeable feature of all is, of course, the rise in the price of fuel, which has been out of all proportion to the improved economy effected by the employment of the best carburetting devices. Matters will no doubt improve after the war, particularly because it is more than probable that the supplies of benzol then freed will be large. At present there is no inducement to use heavier fuels of the paraffin or white oil order, and at no time can such fuels be regarded as offering a satisfactory way of escape from the high prices of petrol, because they are imported and distributed by the same companies, and the supply and price can thus be regulated so as to maintain the price of the lighter fuels. They do, however, represent a factor in the total fuel supply of the world, and therefore in the general relationship of supply and demand. We hear now that the Government proposes to develop the oil resources of the British Isles, and this may have a restraining effect on the price of fuel. One of the latest contributions to the fuel question is a book on "Industrial Alcohol," by Mr. Robert N. Tweedy. Mr. Tweedy hopes to see alcohol fuel produced in very large quantities from potato crops to be grown under improved agricultural conditions in Ireland. If this could be made an economic possibility, it would, of course, be ideal, inasmuch as when this alcohol supply had been added to our benzol we should be completely independent of imported fuels, even if nothing much were to come of the Government's proposals for getting oil. The great trouble is, however, the question of the cost of the raw material, as represented by the potato crop. To make the whole proposition a commercial one, two conditions must be fulfilled. One is that the raw material must be obtainable at such a price that the fuel alcohol can subsequently be retailed at not more than about 70 per cent. the current price of petrol. At any higher figure it would not be competitive so long as it has to be burned rather inefficiently in a petrol engine. The other point is that unless the business were supported by a State bounty, it would have to show itself a better scheme than the import of industrial alcohol from tropical countries. In some of our colonies alcohol crops could be grown at a negligible cost. The problem therefore is whether the cost of bringing the denatured fuel to this country in bulk from the colonies in question would not be very much lower than the additional cost of using home-grown crops for the distillation of alcohol. We freely admit the desirability of the latter course on national grounds, but Mr. Tweedy has not convinced us that it would be economically sound.

* * * * * *

While discussing any questions connected with fuel we ought perhaps to touch upon the subject of the taxation of public service motors, either on a basis of the mileage covered or through the medium of the fuel employed. Motor omnibus services ought not to escape taxation altogether, because these vehicles undoubtedly affect the life of the roads they use. Under the original scheme of taxation, however—setting aside the hackney carriage licences as comparatively trifling—the basic idea was to tax the motor omnibus for the benefit of the roads of the country as a whole, and not specifically for the benefit of those roads upon which it runs. Probably this scheme was, taken all round, the best that could be devised, though it is difficult to see why a municipal motor omnibus service, running within a strictly limited area, should make any payments at all towards the improvement of roads outside that area. It could only be assumed that the Road Board, in distributing the proceeds of the tax, would take the existence of such omnibus services into account, and give the most favourable possible consideration to applications for grants coming from the districts where those services might operate. This possibility had not in it enough certainty to please the local surveyors. Hence, we have now a second and totally different system of taxation in addition to the first. The new idea is to levy a charge on the omnibus service for every mile run, and to apply the proceeds to the maintenance of the roads used by the service. Assuming that the charges made are reasonable, and are not, as has been suggested, made subject to perpetual revision and increase, designed to wipe out almost all the profits of the omnibus concern, there is nothing inherently unfair in this system. It is nevertheless altogether unfair to adopt both methods of taxation together. If the omnibus pays directly for the use of certain roads, it should not pay indirectly and in addition towards the maintenance or improvement of roads which it never uses. If, on the other hand, it makes its fair contribution to the national fund, it ought to be clearly understood that its obligations in respect of road maintenance and improvement are fully met thereby, and that no local dues are to be extorted. If we consider the case of, say, Eastbourne, where there are no tramways, and where, consequently,

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# MOTOR TRAFFIC.

there can be no argument to the effect that the tramways are taxed more severely than the omnibuses, we see at once the absurdity of penalising the ratepayers of that town by making them pay for roads in other districts merely because they happen to prefer to use motor vehicles in place of tramcars in their own locality.

The recent attempt on the part of taxicab drivers to coerce the railway companies into giving them free and uncontrolled use of their station yards seems to be merely another piece of evidence in favour of the theory that the development of the taxicab is at present largely on a wrong basis. In the old days of the horsed cabs the cabman was to all intents and purposes his own master. As such he made a fairly satisfactory living by alternately cajoling and bullying the public into the payment of exorbitant fares. He made the great mistake, however, of supposing that this state of affairs was everlasting. He was more noteworthy for a certain crude eloquence and caustic humour than for his breadth of view, and so it came about that when the taximeter was introduced he saw in it nothing but an objectionable means of curtailing his profits. The result of this was that the early taxicab companies—in which the drivers figured as employees instead of as the hirers of cars—were given an opportunity of gaining rapid popularity with the public. The motor cabs in themselves were novelties, and the taximeter was a welcome assurance against overcharge. The motor cab drivers at that time did not find the conditions of employment irksome, because the cream of the business came automatically their way. The difficulty of treating the cab driver as an employee became evident, however, as soon as competition between companies grew acute and profits were consequently reduced to a narrow margin. The companies, in the interests of their shareholders, were obliged to indulge in stringent economies and rigid supervision. Drivers who had been quietly annexing any payments for extras found it increasingly difficult to do so, and various promising schemes for getting the better of their employers were more or less nipped in the bud. Meanwhile the price of petrol went up, and as the drivers had to supply their own fuel, this hit them rather hard. From that time up to the present day the fundamental error underlying the whole constitution of the taxicab companies has become more and more apparent. The roving life of a cabman, who cannot be subjected to the constant attentions of an overseer or foreman, encourages independence of character and the development of considerable ingenuity and craft. No amount of regulations will make it impossible for the taxi driver to pocket a certain sum of money that rightfully belongs to his employer. The men no doubt feel that they have grievances, on account of which they consider themselves justified in "making" what they can out of the companies. In any case their morals in small matters become lax, and they exhibit the same tendency as the old cabby to bully the public and disregard its interests whenever they find that they have the upper hand. Probably the root of the matter lies in the cabman's mode of life, and as this cannot be materially altered it is impossible to find any complete remedy. The weakness of the system of the operating companies lies partly in the fact that their men have plenty of time in which to discuss grievances and exchange ingenious ideas for gaining small profits, and partly in the fact that the men take little or no personal interest in their cars, and consequently are more often than not bad and dangerous drivers. Probably the best compromise would be the elimination of the companies in favour of small proprietors and owner-drivers. This system is, of course, inferior as regards facilities for maintenance and repair, but it introduces the element of personal interest and the power of private bargaining not necessarily accompanied by any dishonesty. In the long run, it gives the advantage to a man who is a good driver, and who handles his public tactfully and with a reasonable measure of courtesy. It would be worth the while of any licensing authority to consider whether it is not to the advantage of a locality that its motor cabs should be owned by their drivers, or at least by people who run very small fleets, rather than that the whole business should fall into the hands of one or two companies, and satisfactory service be dependent upon the variable relations between those companies and their men.

## GREAT RISE IN PETROL.

A sensation was produced on September 3 by the public announcement being made that as from that date the price of petrol was increased by 8½d. a gallon. The Shell Marketing Company sent out the following circular:—

"We regret to have to inform our customers that owing to the enhanced cost of ocean transportation, consequent on the great increase in the rates charged under the Government's War Risk Insurance, we are compelled as from Monday, September 3, to advance our prices to the extent of 8½d. per gallon to meet the above-mentioned extra causes."

The Anglo-American Oil Company's circular ran:—

"Owing to the enhanced cost of petroleum products, and in particular to the advance in the cost of ocean transportation, consequent on the great increase in the rates charged for War Risk Insurance and other causes arising out of the war, the company are compelled, as from Monday, September 3, to advance their prices to a level which will help to meet the extra cost."

The former document refers to motor spirit and the latter to petroleum for fuel, lighting, etc.

While previous increases of price were due to the higher cost in the countries of production, the present rise is attributed wholly or almost wholly to the new Government shipping insurance charges. It is, in fact, plain that the Government have struck a heavy blow at a great industry. In the middle of August the Government scheme of war risk insurance then in force was very considerably modified, with the result that while the position of the owners of requisitioned tonnage was improved, insurance rates for the so-called "free ships" were very substantially advanced. The total cost of war insurance for oil tank vessels, which, on the average, make about seven round voyages across the North Atlantic, is now admittedly very heavy. The charge falls particularly heavily on the shipowners, because of the greatly enhanced values of tonnage. A new ship may cost between five and six times the amount of the pre-war value, and such increased values have naturally to be insured by the owners. According to some authorities the rise in the insurance rate is from 4 per cent. (the old figure) to 18 per cent. of the market value of the ship.

The ordinary retail price of petrol recently was about 3s. 4d. per gallon, and the increase brings it to about 4s. Under existing contracts motor cabs in London were reported to be getting the spirit at 2s. 3d. per gallon, or 2s. 6d. without the rebate of duty. Omnibuses were on a similar basis. As existing contracts run out higher prices will have to be paid. That will mean additions to fares. In the case of manufacturers, shopkeepers, and others who use petrol vehicles for transporting goods and parcels, there will also be an additional burden, but it will not be so severe as on those whose business is transportation alone.

FARES AT BRIGHTON AND HOVE.—Provided that Brighton Corporation also agrees to the proposed revised scale of fares, the Corporation of Hove have approved of increased fares being charged on the motor omnibuses run by Tillings, Limited.

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# MOTOR TRAFFIC.

## COAL GAS FOR MOTOR TRACTION.*

REPORT OF THE EXECUTIVE COMMITTEE OF THE BRITISH COMMERCIAL GAS ASSOCIATION.

It is on record that the use of coal gas for motor traction is at least 20 years old, so that its practicability for certain kinds of work is beyond question. Recently, however, the shortage in the supply of petrol, and its high price, has revived interest in the use of gas, and in order to get some definite information on the subject, the B.C.G.A. undertook a series of experiments. Without unduly labouring the point, it may be stated that many unavoidable delays occurred in the pursuit of the experiments due to the abnormal conditions prevailing at the present time. Such observations as have been made will, it is hoped, serve to clear up the technical aspects of the question and enable those interested to consider the matter from their respective points of view.

The use of gas for traction is, as has been said, by no means a new subject. There is, of course, no essential difference between a gas engine and a petrol engine; they both use combustible gases with air for the development of their power, and their methods of operation are such as to make the adaptation of one to the other a fairly simple matter. To convert a gas to a petrol engine, the principal alteration needed is the addition of a carburettor, and the adaptation of gas to a petrol engine simply renders the carburettor a superfluity.

### ADVANTAGES AND DISADVANTAGES OF GAS.

There are special advantages attaching to each form of fuel—gas and petrol. Petrol, for instance, possesses the immense advantage of containing a large amount of energy in a small space. Gas, on the other hand, is for practical purposes a "perfect gas," not a vapour, and therefore conduces to clean cylinders and pistons, absence of trouble due to injector stoppage, and the complete elimination of starting difficulties in cold weather.

Gas, however, for equal energy value is very much more bulky than petrol, and herein lies the only real difficulty in connection with the use of gas as a substitute.

### THE RUNNING-IN OF PETROL ENGINES BY GAS.

It is well known that gas can be, and is, economically employed for "running in" automobile and aeroplane engines with a success which might easily have been anticipated. In these cases, however, the engine is mounted on a test bench, and gas taken from an ordinary gas main, so that questions of storage, breaking down of high pressures, and replenishment of fuel do not enter into the question. The problem is therefore a relatively simple one. One point, however, in this kind of work which has come to notice recently might with advantage be placed on record here.

In a large establishment where automobile engines were being "run in" on gas it was found that the piston and cylinder walls became corroded. This was regarded as a serious objection, involving as it did the risk of the pistons jamming. It was found that the trouble was due to excessive cooling of the engine. The circulating pump operated by the engine was fed from a water main having a head of from 20 lb. to 30 lb. per square in. The pump being of the non-positive type permitted the water to flow through the jackets by virtue of the head on the main even when the engine was stopped. Under these conditions a much larger volume of water passed through the jackets than would have been the case if the water had been allowed to flow under the propulsive action of the pump alone, so that excessive cooling of the products of combustion took place and ultimately caused corrosion.

The solution of the difficulty consisted in the provision of a small tank with float valve set about level with the engine. Water supplied to the engine from a tank arranged in this way would naturally flow at a rate dependent on the speed of the circulating pump, and therefore on the speed of the engine, which, after all, is but a reproduction of normal working conditions.

Similar precautions would have to be taken with engines cooled by "Thermo-Syphon."

When gas is used on a mobile vehicle several limiting conditions present themselves, inasmuch as the gas for driving the engine must be carried by the vehicle itself. The question of storage, therefore, arises first.

### THE USE OF THE GAS BAG.

From information that has appeared in the technical press, the use of gas for motor traction has been successfully worked out by Messrs. Barton Brothers, of Beeston. Their arrangement consists of a flexible balloon-like holder carried on the roof of the vehicle. The holder is made of woven fabric treated so as to be impervious to gas and to withstand the effects of the weather. They are made in various sizes from 150 to 500 cubic ft. capacity. The gas is therefore stored under a very slight pressure, probably only a few tenths of an inch head (water-gauge) above atmosphere, and this pressure is steadily maintained as the holder exhausts itself in feeding the engine. So far as the engine is concerned, the low pressure of the gas in the flexible holder is of no consequence. The gas flows into the engine just as the air does; that is by the inductive power due to the operation of the engine itself.

### ADVANTAGES OF THIS SYSTEM.

This method of carrying the gas has several obvious advantages, namely:—

(1) The holder can be easily and cheaply replenished with gas from any ordinary supply.

(2) It behaves as its own constant-pressure governor, thus obviating the necessity for auxiliary governing accessories.

(3) There is no need for gas-compressing machinery.

(4) The holder is cheap to instal.

(5) It adds very little to the weight of the vehicle.

A small advantage arises from the fact that the gas is stored at practically its normal density, and therefore exerts a certain buoyant effect, but as this amounts to only 35 to 40 lb. per 1,000 cubic ft. of gas on the vehicle, it cannot be regarded as of much consequence.

### DISADVANTAGES OF THE GAS BAG.

The practical disadvantages of this system are the extremely fragile nature of the holder and its bulky dimensions, which seem to unfit it for hard work in the towns.

Nevertheless, the simplicity and low cost of the system warrants careful consideration as a war measure, because although the volume of gas that can be carried at atmospheric pressure is limited owing to its bulk, this is to some extent compensated for by the ease with which the gas holder can be replenished. Indeed, in the present state of the iron trade, it is difficult to see how gas can be applied in any other way.

It should be fairly easy to provide at many places facilities for replenishment through an ordinary meter of sufficient size, and in certain cases it might be practicable to supply gas through prepayment meters.

It may be advisable to mention here that owing to the very small pressure exerted by the gas contained in a flexible holder—only about two-tenths of an inch water-gauge—a meter discharging into it would discharge practically as though it was open to the atmosphere, and would therefore race unless some form of throttle were used. A short length of small pipe or a diaphragm with a suitable aperture fitted on the inlet to the meter is recommended, so as to keep the "pressure drop" in the meter itself within safe limits.

### THE STEEL CYLINDER SYSTEM.

To overcome the two serious drawbacks of what might be called the "Beeston" system, namely, the fragility and bulky character of the gas holder, the use of gas compressed at high pressure in strong steel containers presents itself. This permits of the bulk being reduced to a reasonable figure, and also provides an apparatus robust enough to bear any reasonably hard wear. In doing this, however, all the advantages of the "Beeston" system have to be sacrificed, so that an entirely new set of conditions arise.

From a practical engineering point of view the use of gas compressed into steel containers is far the better, but its adoption is for the future. The present state of the steel market is such as to preclude any serious work in this direction for some time to come, but nevertheless a few general remarks on this aspect of the question might not be without interest.

### THE QUESTION OF PRESSURE.

The compression of gases is now a well understood commercial business. The British Oxygen Company have a large organisation for dealing in gases stored at 120 atmospheres (1,800 lb. per square in.), and this may be regarded as practically the maximum pressure that can be easily dealt with, although pressures as high as 200 atmospheres (3,000 lb. per square in.) have been used on the Continent.

When the question of gas for motor traction was raised last year, there was a considerable weight of opinion in favour of the use of

* In our issue of August 16 last, we referred to this report of the Executive Committee of the British Commercial Gas Association on the important subject of coal gas for motor traction. Although the main arguments and conclusions were then dealt with, the report is so informative and contains so much of value at the present time, that we reproduce it in full.

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# MOTOR TRAFFIC.

gas at 120 atmospheres. There are, however, several objections to this, namely :—

(1) The high cost of compression.
(2) The care and supervision required in dealing with cylinders stressed to this degree.
(3) The liability of the metal to more rapid "fatigue" due to continual vibration.
(4) The depreciation of the gas by subjection to such a high pressure.

It was intended to make some experiments with gas stored at this extreme pressure, but it was found to be impossible owing to the lack of the necessary material and apparatus.

Experiments were, however, made on the lines along which ultimate success will probably lie, if gas is at all practicable on a large scale, namely, the use of moderate pressure up to 20 to 25 atmospheres (300 to 375 lb. per square in.). For this purpose we were fortunate in procuring from the G.W.R. some steel cylinders capable of supporting a pressure of 20 atmospheres. The question of getting the gas at a sufficiently high pressure then arose, and although an endeavour was made to adapt some existing apparatus for the work, it was in the end decided to make use of the compressed gas supplied by the British Oxygen Company. This is supplied in cylinders compressed to 120 atmospheres, and it was found quite practicable for experimental purposes to transfer this gas to the low-pressure storage cylinders through a reducing valve discharging at 20 atmospheres, flexible tube of heavy section being used for connecting up.

### Gas in Use on a Tramway.

It is on record that the Neath Tramways are operated by gas power, the gas being carried under an initial pressure of about 200 lb. per square in. There is, however, a considerable difference between the operation of tramway vehicles and ordinary commercial motors. For instance, the resistance to traction on an ordinary road might be anything up to three or four times as much as the resistance on a tramway track; also with a car operating between fixed limits not very far apart, a relatively small charge of gas would be sufficient for a "to and fro" journey, thus minimising the dead weight of the storage reservoirs. The reservoirs could, if necessary, be replenished after each "out" and "home" journey.

### Effects of Compression on the Gas.

It will be useful at this stage to consider some of the effects of compression of gas to a pressure suitable for use in a mobile engine.

Ordinary town's gas is not a "perfect" gas. Even when compressed to a moderate pressure of only a few pounds per square inch above atmosphere, the "partial-pressure" of the water it contains is not sufficient to keep the whole of it in the vaporous state when the slight elevation of temperature due to compression disappears.

At 60 deg. F. the tension of aqueous vapour is ·518 of an inch of mercury, which, with gas at standard atmospheric pressure, corresponds to the presence of 1·7 per cent. of water vapour in the gas. If the pressure of the gas is raised to, say, 10 in. of mercury above atmosphere the volume of the gas will change in the proportion of 4 to 3, so that when the gas regains its normal temperature of 60 deg. F. one-fourth of the water it originally contained in the form of water vapour will separate out in the liquid state, that is supposing it was saturated with water vapour before compression.

It is not until considerably higher pressures are attained that the hydrocarbon bodies in the gas are appreciably affected. Naturally, the precipitation of any of these detracts from the calorific value of the gas. The effect of compression to 120 atmospheres appears from observation to reduce the calorific value by about 10 per cent. A cylinder of gas at 120 atmospheres was discharged through a reducing valve into a calorimeter and frequent observations made of the heat developed. It was found that the calorific value remained almost absolutely constant during the time the gas was discharging and the pressure falling. There was, however, a rise in the number of B.T.U. developed during the last few minutes when the pressure was falling from about 3 atmospheres to atmospheric datum, presumably due to the partial re-evaporation of some of the hydrocarbons which had been precipitated. The main point, however, is that almost the whole gas can be discharged at a practically constant calorific value, and this value is 10 per cent. lower than before compression.

### Negligible Effect of 25 Atmospheres.

Regarding the effect of the calorific value due to compression to 20 atmospheres, there has been no opportunity of determining this under present conditions, but from some observations made about seven years ago it was found that the loss due to compression to 300 lb. per square in. (about 20 atmospheres) was from 3 to 4 per cent., so that making due allowance for the difference in constitution of the gas at the present day the effect of compression would be less than 3 per cent. and probably practically negligible.

It should be pointed out that the loss of calorific value at 20 and 120 atmospheres pressure, as described above, was determined after the gas had been re-expanded and allowed to regain its full 100 per cent. humidity by passage through a wet meter. The compression even to only 20 atmospheres would cause the gas to deposit 95 per cent. of its normal water contents, and so become, when re-expanded out of contact with water, for all practical purposes dry, so that in regaining its 100 per cent. humidity about 1·7 per cent. of diluent (water vapour) was added. In practice the gas would have very little opportunity of taking up water on its release from the storage cylinders, so that it would be used in a practically dry state, and the avoidance in this way of the 1·7 per cent. dilution by water vapour would practically compensate for the loss of calorific value due to deposit of hydrocarbons at 20 to 25 atmospheres compression.

### Liquid Deposits in Cylinders.

A question arises as to the nature of the hydrocarbons thrown down by compression. Naphthalene will be precipitated, but observations go to show that there is always a sufficiency of liquid bodies to prevent the naphthalene assuming the solid form. These liquid bodies, however, have a tendency to polymerise, so that it appears desirable that containers for high-pressure gas be fitted with drain cocks, and perhaps provision should be made for the occasional use of a small hand-operated spraying device to facilitate the outflow of viscid deposits. This should not prove a serious matter.

At first it would appear that the only effect of an accumulation of viscous or sticky deposits in the storage cylinders would be slightly to reduce their capacity. It points, however, to an important practical distinction between the use of moderate storage pressures (up to 25 atmospheres) and extreme pressures up to 120 atmospheres, with a great advantage in favour of the former for the following reasons:—While there will certainly be a larger deposit of hydrocarbons at the extreme pressure, there will at the same time be greater difficulty in cleaning out the containers. In fairly large containers working at 25 atmospheres, it would be quite practicable to affix a hand-operated sprayer for the injection of a paraffin spray at certain intervals, but with extreme high-pressure gas containers this does not seem a sound proposition for practical reasons. In the latter case it would probably be found necessary to expel the deposited matter by means of heat, which would mean the dismantling of the cylinders—an expensive job. Also the periodical re-heating would in time adversely affect the ultimate strength of the cylinder by corrosion of its surface and consequent loss of sectional area, and this seems to be a weighty reason in addition to those already enumerated against the adoption of pressures higher than 25 atmospheres. Another point is that with 120 atmospheres the reservoirs would be smaller and the deposits greater than at 25 atmospheres, so that the volumetric capacity of the reservoirs would suffer serious diminution unless they were frequently cleaned.

### A Trial Run.

A car having been equipped with gas reservoirs it was run round a district having just about the average kind of road and variations of level, and the observations made indicate *a radius of action of 25 miles per 1,000 cubic ft.* The average speed was nine miles per hour, including the stopping and slowing down which was several times necessary at crossings, etc., but which is, of course, consistent with everyday conditions.

It was intended to make some comparative brake tests with the engine, and so see if and to what extent its power was lessened by the substitution of gas for petrol. This has not been possible, but Messrs. White and Poppe, of Coventry, have kindly given permission for the results of some observations made by them to be included in this report. (See a paper read by Mr. G. B. Jones, of Coventry, *Gas Journal*, March 27, 1917.) These observations were made with gas that had not been compressed to more than a few inches head of water, but so far as the data of relative power are concerned, there is no reason for doubting that they apply equally well to gas that has been compressed, making due allowance for loss of calorific value due to compression, which, however, as has already been pointed out, may be regarded as negligible for pressures not exceeding 25 atmospheres.

The results obtained at Coventry show that the brake power developed by a petrol motor when driven by gas is about 85 per cent. of the power developed by petrol, and that this proportion is fairly constant over a wide range of speeds; also for equal brake-power on test bench, *one gallon of petrol appears to be equivalent to 250 cubic ft. of gas.*

Our own observations derived from general running of a vehicle on petrol and gas point to a ratio less favourable to gas, namely, that one gallon of petrol is equivalent to 300 cubic ft. of gas.

Much, however, of course, depends upon the quality of the gas and the kind of petrol used, there being several qualities of both procurable at the present time.

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### Data Relevant to Storage under Pressure.

The weight and volume of the steel containers for storing the charge of gas are factors of importance, but their significance will vary with the type of vehicle under consideration. The following figures are interesting and useful on this point :—

| Dimensions of Reservoirs. | | | | Weight of Reservoirs per 1,000 c. ft. of free gas. | Press. atm. | Vol. of free gas. (c. ft.) | Price. |
|---|---|---|---|---|---|---|---|
| Length ins. | Diam. ins. | Vol. c. ft. | Weight lbs. | | | | |
| G.W.R.— | | | | | | | |
| 84 | 18 | 11·2 | 326 | 1455 | 20 | 224 | — |
| 99 | 14 | 10·37 | — | — | 20 | 207 | — |
| 84 | 36 | 44·8 | 1668 | 1860 | 20 | 896 | — |
| Uxbridge Steel Barrel Co.*— | | | | | | | |
| 72 | 26 | 20·0 | 780 | 1560 | 25 | 500 | 238s. |
| 72 | 20 | 12·0 | 480 | 1600 | 25 | 300 | 177s. |
| 72 | 15 | 6·0 | 285 | 1900 | 25 | 150 | 102s. |
| British Oxygen Company.— | | | | | | | |
| 49 | 7 | ·83 | 108 | 1080 | 120 | 100 | 93s. |

* The cylinders by the Uxbridge Steel Barrel Co. conform to the following specification :—

To be made of mild steel plate with welded joints, the plate having a tensile strength of 25/26 tons per square inch. The bosses for attachment of connecting tubes to be welded to the cylinders. The cylinder ends to be domed outwards with a radius equal to the diameter of the cylinder.

It is clear that in adopting gas a considerable proportion of the carrying capacity of the vehicle would have to be sacrificed, or, to put it in another way, the wear and tear on tires and other running parts would be increased per ton of goods carried.

The use of gas at 120 atmospheres pressure would mean a tangible economy in regard to weight, and this could no doubt be reduced still further by the use of stronger material, such as nickel steel. There remains, however, the fact that these cylinders work at a low factor of safety, which in turn necessitates a degree of supervision which seems hardly practicable with reservoirs used for the storage of gas for motor traction. These extreme high pressure cylinders also work out more expensive per 1,000 cubic ft. of free gas than cylinders for the more moderate pressure of 25 atmospheres, but this in itself is an item which would soon repay its cost by the higher carrying capacity of the vehicle, due to the smaller dead weight.

### The Disposition of the Storage Cylinders.

As regards the disposition of the vessels on the vehicle, this will depend upon the type of vehicle and other circumstances, and need not be further discussed here beyond stating that it might be found convenient to use several vessels of various sizes according to the dimensions of the vacant spaces on the car, although the weight per 1,000 cubic ft. of gas is less the larger the vessel used.

It is worth pointing out, too, that the loss in the carrying capacity of the car, due to the weight of the gas reservoirs, provides at the same time space for their installation. The several storage units would be coupled together by means of solid drawn ⅜-in. copper tube, which weighs only 4½ lb. per 10-ft. run, and can be safely used up to a pressure of 500 lb. per square in.

Respecting the question of weight, there is reason for thinking that in post-war time this will be found less formidable than at present. One of the good results of the war has been the manufacture of steel of immensely greater tensile strength than were known three years ago, and we think it is not an exaggeration to say that the weights mentioned above will be found capable of a reduction of 50 per cent. or more.

### Compressing Machinery.

Gas compressing machinery is a well-understood branch of engineering, but for the experiments it was found, owing to war conditions, almost impossible to get a machine in London for the purpose, so that, as has already been mentioned, it was necessary to use gas stored at 120 atmospheres by letting it down to 20 atmospheres through a reducing valve.

The following information on this head is useful :—

| Output of Compressor. | | Pressure lbs. per sq. in. | Power required at belt. | Cost of Compressing Machine only. |
|---|---|---|---|---|
| c. ft. per min. | c. ft. per hr. | | | |
| 25 | 1,500 | 300 | 6½ H.P. | £275 |
| 137 | 8,200 | 300 | 34 H.P. | £400 |

To this must be added the cost of engine and erection, and a certain amount of storage in the form of a battery of reservoirs used in conjunction with the compressors at the replenishing station.

It is useful to note that for compression to 120 atmospheres the power required would be between two and two and a half times as much as is necessary for compression to 20 atmospheres, depending upon the type and efficiency of the machine used.

The amount of storage provided at the compressing station, and the size of compressors, will depend, of course, upon the demand for compressed gas, but in any case the use of storage in conjunction with the compressor would shorten the time needed to replenish the reservoirs on a car. These station storage units should, for economical as well as mechanical reasons, be of the multiple type rather than in the form of a single reservoir, and should be worked at a pressure rather higher than that required on the car, so as to compensate for the drop of pressure that would take place when the gas was transferred. If when the pressures in the car cylinders and the station storage cylinders had adjusted themselves this pressure were below the working pressure for the car, direct communication with the compressor would allow of the necessary addition being made. A suitable arrangement of valves would permit of this being quickly done. If the compressor were not supplemented by a certain amount of storage capacity in the form of auxiliary reservoirs, it would have to be of such size as to permit a car to be replenished in, say, five minutes, which would mean a compressor of 12,000 to 18,000 cubic ft. per hour capacity, and unless the demand for gas were high this would add unduly to the standing charges, and therefore to the cost of compression.

It may also be mentioned here that no trouble has been experienced due to the reduction of temperature consequent upon the expansion of the gas after release from the storage cylinder. The gas was observed to chill immediately after release, but nothing else ; the conductivity of the metal surroundings being sufficient to make up for the absorption of heat due to the expansion of gas.

### The "Beeston" System in Growing Use.

It may be mentioned that the low pressure or "Beeston" system is already being adopted owing to its simplicity. The weight of the envelope is (as has already been mentioned) such that the gas exerts a pressure equal to only one or two-tenths of an inch head of water, and when it is remembered that a normal adult person can blow by means of the lungs a pressure of about 80 in. head of water, it will readily be seen that the pressure in the envelope is extremely small. There is no need for it to be large so far as the engine is concerned, because the suction due to the operation of the engine is more than ample to draw in the gas.

Regarding the equivalents of gas and petrol, the gas supplies in different parts of the country are, like electric supplies, not standardised either as to price or quality, and it will be found that the gas obtained at some places will give a better mileage than gas obtained at another place. The gas equivalent is, however, unlikely ever to be higher than 300 cubic ft. per gallon of petrol, but may be as low as and even lower than 250 cubic ft. These figures, together with local prices for gas and petrol, will enable those interested to calculate the relative costs of running.

## SOME OBSERVATIONS ON THE NEATH GAS CARS.

### Lay Out.

The general lay out of the system is as follows :—The compressing depot is situated in a central position at Neath, from which the track extends southwards in one direction two and a half miles to Britton Ferry and in the westward direction two miles to Skewen, the total length being four and a half miles. Only three cars are running at present, three others being laid up for repairs, which under present conditions are difficult to carry out.

### Working.

The gas reservoirs on the car are replenished to a pressure of about 140 lb. per square in. each time they return to the central depot, so that the longest journey travelled on one charge is the five miles out to and back from Britton Ferry. The replenishment is a very simple matter, and takes only two minutes.

At every second return of the car to the depot (that is after a journey of nine miles), the cooling water of the driving engine has to be changed. This is due to imperfect cooling arrangements and to the close confinement of the engine and accessories ; a condition that does not exist in an ordinary automobile vehicle.

### Engine and Track.

This is a 15-H.P. two-cylinder engine, the piston diameter and stroke being 8½ and 10 in. respectively, and runs at a speed of 264 revolutions per minute. It is balanced by a flywheel about 4 ft. in diameter, which is enclosed in a case outside but close up to the side of the vehicle. The engine drives through a two-speed and reverse gear, and when once started generally continues in motion until the end of the day.

The track has a few gradients, the worst being 1/27 and 800 ft. long. With a full load the car ascends this gradient at slow speed, but with only a small margin of power.

### Compressing Installation.

There are two two-stage compressors, each separately belt-driven by a 6-H.P. gas engine. Generally one compressing set can provide sufficient gas for the cars, so that the second set acts as a stand-by.

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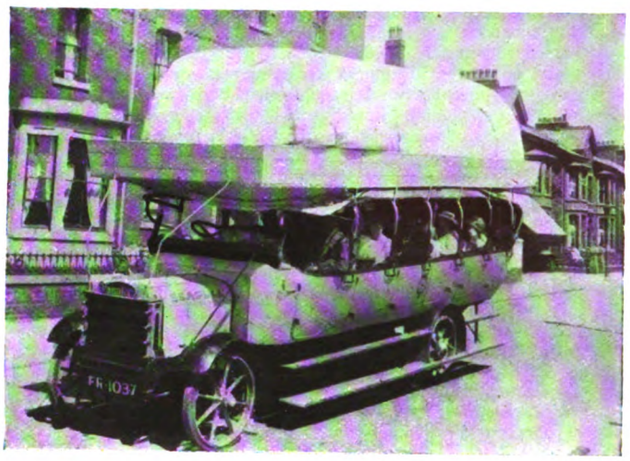
Each compressor has a maximum output of 40 cubic ft. per minute, that is, 2,400 cubic ft. per hour. They discharge into a set of three storage reservoirs each 20 ft. long by 4 ft. 3 in. diameter with domed ends, and having a volume of about 300 cubic ft. At 200 lb. per square in. each of these reservoirs would hold about 4,000 cubic ft. of gas, that is, a total of 12,000 cubic ft. for the three. The connections on the reservoirs allow of their use jointly or separately. The compressing plant is generally run for about 12 hours a day, whereas the cars are running for about 16½ hours, the difference of 4½ hours being provided for by the gas stored in the reservoirs.

### The Cars.

There are two types of car, but they differ only in regard to size, being 7½ tons and 8½ tons respectively, the smaller one carrying 40 passengers and the larger one 52, but are driven by engines of the same size, namely, 15 H.P. They travel when fully loaded at a maximum speed of ten miles per hour.



**Daimler Chars-a-bancs Using Coal Gas.**

[One of four Daimler Chars-a-bancs supplied to Messrs. S. & J. Wood, Ltd., South Shore, Blackpool. This vehicle is fitted, as will be seen from the photograph, for using coal gas as fuel, and it is giving very satisfactory service.]

The gas is carried in three domed-end cylindrical reservoirs, one at each end of the car underhung from the chassis (these are 4 ft. long by 1 ft. 9 in. diameter), the third being 13 ft. 6 in. long and 1 ft. 6 in. diameter, and is arranged underneath one of the seats inside the car. This third cylinder practically balances the weight of the driving engine, which is arranged under the opposite seat. The total volume of the three cylinders amounts to about 45 cubic ft., and assuming the initial storage pressure to be 140 to 150 lb. per square in., would contain between 400 and 450 cubic ft. of available gas when fully charged. The consumption of gas (including the gas used by the compressing engines) works out at 78 cubic ft. per car mile, and if we deduct 10 per cent.* as the amount actually used by the compressing engines, we get 70 cubic ft. of gas per car mile as the amount actually used for traction, or about 14 miles per 1,000 cubic ft. Therefore with a single charge of 450 cubic ft. of gas a car would be capable of travelling a maximum distance of about six and a half miles. The longest journey actually travelled is from the depot at Neath to Britton Ferry and back, a distance of five miles, so that generally the car carries a reserve of gas equal to about a one and a half mile journey.

### Costs of Running.

For the 12 months ended July, 1916, they were as follows:—

| | | |
|---|---|---|
| Total expenses | ... ... | 9·5d. per car mile. |
| Expenses for gas only | ... | 3·1d. ,, ,, |
| Gas used for traction | ... | 70 cubic ft. per car mile. |
| Gas used for compression | ... | 8 ,, ,, ,, |
| Total | ... ... | 78 cubic ft. per car mile. |

78 cubic ft. at 3s. 4d. equals 3·12d. per car mile for gas only.

Having regard to the small size of the Neath tramway service, and the fact that the apparatus is very much out of date, the total expense of working, namely, 9·5d. per car mile, seems a very satisfactory figure. In the absence of details it is difficult to compare this figure with other forms of traction, but it is worth noting that it is on record that the total expenses for running the London omnibuses during 1912 was 7·32d. per omnibus mile. Taking into account the facts that materials, etc., were fairly cheap in 1912; that the London omnibuses have the advantages of a large organisation; and also that their weight is about 25 per cent. less than the Neath cars, the gas-driven cars compare favourably with them.

### Effects of Compression to 200 lb. per Square Inch.

An examination was made of the gas used, and of the oily substances deposited in the storage reservoirs, and the results show that the effect is negligible. The loss of heat value is less than 1 per cent., and this is more than compensated for by the almost complete dehydration of the gas due to its concentration by pressure. These observations confirm to some extent the conclusions come to respecting the effect upon the gas of subjecting it to a pressure of 25 atmospheres.

* No data were available showing the gas used for compression only, but 10 per cent. may be regarded as a fairly accurate estimate, on the assumption that the compression is carried to 200 lbs. per square inch.

## U.S.A. WAR TAX ON MOTOR SALES.

### Manufacturers' Objections.

The National Automobile Chamber of Commerce of the United States have raised opposition to the proposed war tax of 5 per cent. on the total sales of motor vehicles. The Chamber's statement mentions that the industry includes approximately 450 manufacturers, of which 12 makers produce 80 per cent. and 438 produce 20 per cent. of the whole. The twelve have been prosperous, while the bulk of the others are able to exist only in good times. The volume of sales has been decreased since the war. Increased prices would further restrict the volume of sales. Hence the maker would have to bear the full weight of the tax, which would cripple the majority of the small and financially weak companies. Labour costs have increased 25 per cent. and more in the past year or two. Materials have increased anywhere from 30 to 400 per cent. These rises in the cost of production have been met because of the larger volume of sales which the war is curtailing. In crippling the motor vehicle industry 825 parts and accessories makers, 25,924 dealers, and 23,686 garages would also be affected. Few of the manufacturers show over 12 per cent. profit on their turnover. This tax, assuming that it could not be passed on to the consumer, would take five-twelfths of the profits, or be a 41·6 per cent. tax on the net earnings of the industry. Very few of the manufacturers after paying this 5 per cent. would have anything left to pay under the excess profits tax. Their net earnings, if any, would be less than 8 per cent. on their investment. More than 600 motor vehicle manufacturers have failed during the past five years.

U.S.A. Industrial Vehicle Exports.—For May last the export of industrial motor vehicles from the United States totalled 1,764, valued at £643,325, as compared with 1,717 and £871,445 in the corresponding month of 1916.

Development of Aeroplane Engines.—Speaking in New York, Lord Northcliffe suggested that the one great hope of allied victory rested in the aeroplane. The war had taught that the aeroplane engine of the spring might be almost useless for actual fighting next autumn, so rapidly are developments produced by the fierce competition of war. The U.S.A. has provided for building over 22,000 aeroplanes.

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## COMBINED MOBILE ARC WELDER AND PNEUMATIC CHIPPING PLANT.

The "Tilling-Stevens" mobile arc welder and travelling workshop has now been rendered more extensively serviceable for executing repairs to engineering plant of every description by the addition of a pneumatic tool outfit. The equipment provides a means of conveying the whole of the apparatus and operators from the owner's door direct to the spot where the work is to be executed, power for driving the pneumatic tools for the preparation and finishing of the work, and current for one electric arc.

The advantage of having the entire equipment mobile, enabling the whole of the gear and workmen to arrive on the job at the same time, will be appreciated by those who have had experence in arranging for the despatch of similar plant by railway. Generally the plant arrives either a long time before or after the workmen have got on to the job, and the delay in collection and delivery

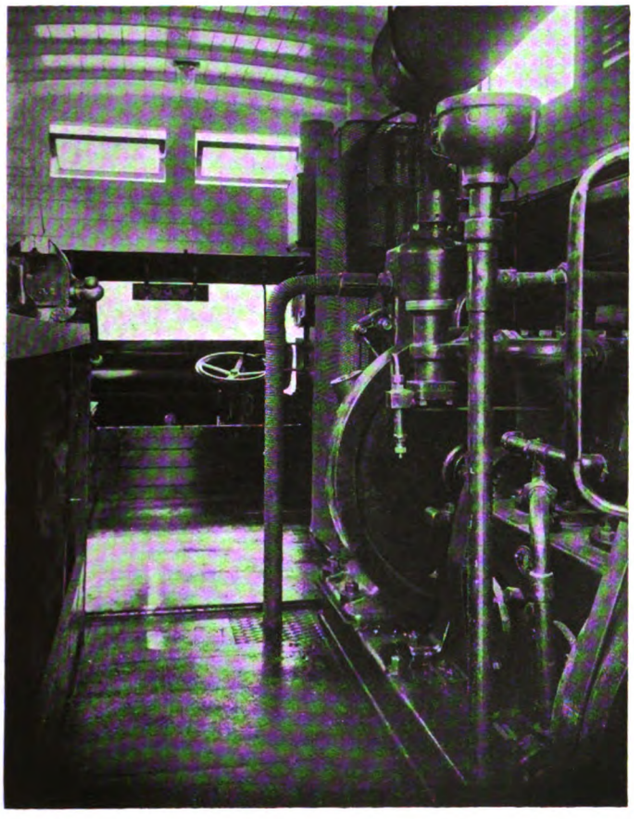

Fig. 2.—Interior View Looking Towards Driver's Seat.

(owing to the fact that in a number of instances there is no tackle to deal with the heavy weights concerned) not only causes a great deal of delay and annoyance, but is also very costly. The particular unit of which interior views are here given was built to the order of Messrs. P. A. Mudd and Company, who are ship repairers and electric arc welders, and the following description, for which we are indebted to Messrs. Tilling-Stevens, conveys a clear idea of the equipment.

The chassis is the standard 40-H.P. Tilling-Stevens petrol electric, fitted with specially wound dynamo and motor for arc welding purposes. In this type of chassis the prime mover, which is a 40-H.P. petrol engine, is direct-coupled to an electric generator, which supplies current to an electric motor, and this in turn drives the back axle through cardan shaft and worm gearing.

The control of the vehicle is effected by means of the engine throttle and a resistance, which varies the strength of the generator and motor fields, the entire range of the speed of the vehicle being controlled by the throttle pedal and resistance lever. Reversibility is obtained by changing the direction of current in the motor field by means of a controller, which also provides a neutral position. Switchgear is arranged for diverting the current from the electric driving motor to the arc welding apparatus, the power being supplied by the same engine and dynamo which normally propels the chassis.

All other mechanical details of the chassis are similar to the standard type which is supplied for passenger and goods carrying. The body is of the box type, and is provided on the near side with hinged glass windows for lighting and ventilation (Fig. 1), and on the off side with one window and louvres for ventilating. The panels are of mahogany, and the whole of the vehicle is painted and finished off in first-class style.

The driver's cab is boarded up on the off side, and there is a hinged door on the near side. A sheet steel weather screen is provided. At the back of the cab folding doors give access to the welding

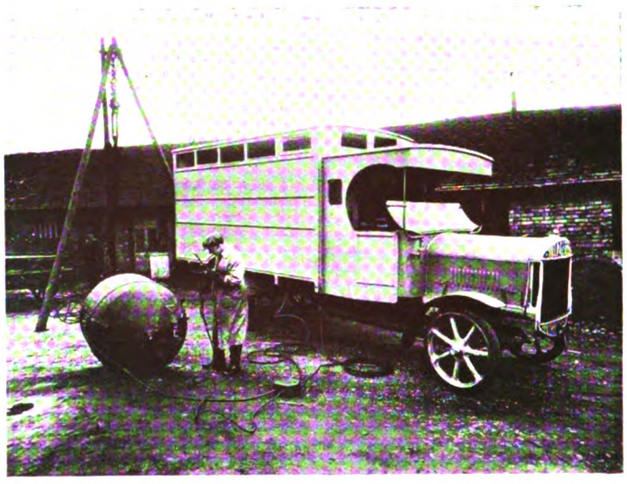

Fig. 1.—Equipment at Work Welding R.M.S. Tank.

control gear, enabling the driver to operate this from the seat. In the interior of the body on the near side there is a locker seat extending for about half the length, and a bench fitted with vice with provision underneath to accommodate the pneumatic hose and cable for welding occupies the remainder of this side of the body (Fig. 3).

The switch gear and resistances for welding are fitted in the front portion of the body on the off side (Fig. 3). The cables from this gear run down through the floor to terminals on either side of the body, to which the welding leads can be connected for running to the point where the arc is required. The welding leads are in

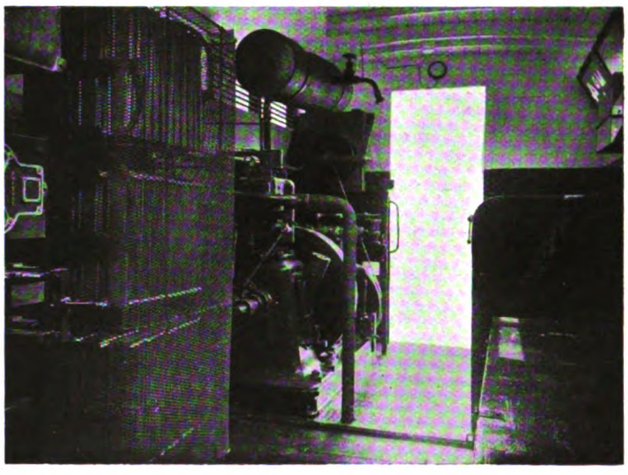

Fig. 3.—Interior View Looking Towards the Rear.

convenient thimbled lengths, and junction boxes are provided for the insulation and protection of the temporary connections.

The air compressing plant is fitted behind the welding gear on the same side of the body (Fig. 2), and is capable of operating a No. 1 Boyer chipping hammer at a distance of 500 ft. from the vehicle. The air compressor is manufactured by Lacy-Hulbert and Company, Limited, and is their "Boreas" standard type, class D.V.1, delivering about 30 cubic feet of free air per minute



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# MOTOR TRAFFIC.

at a pressure of 100 lbs. An automatic unloading device is fitted which cuts the compressor out of action when the pneumatic tools are not being used. The compressor is driven by a 5½-H.P. Gardner petrol engine.

The engine is cooled by means of a radiator fitted at the back of the vehicle, and a fan driven from the compressor draws air from the outside of the body through the radiator. The air compressor is cooled by means of water circulated by a pump round the compressor jackets, and the supply for this is carried in a tank slung underneath the floor of the body. A receiver is slung from the roof. Five hundred feet of armoured hose in 50-ft. lengths, fitted with instantaneous couplings, is supplied, and this length is considered sufficient for the general run of ship repair work.

In addition to the pneumatic chipping hammers, driven by the compressed air plant, the plant can be utilised advantageously for driving pneumatic rivetting hammers, drilling machines, grinders, sand blast apparatus, and other pneumatic appliances and tools. The welding plant is suitable for welding M.S. plates from ⅛ in. thick to 2 in. thick and upwards, all descriptions of steel and iron forgings and castings. Uncaulkable places in boilers can be welded,

**Fig. 4.—Pneumatic Chipping Hammer at Work.**

corroded landing edges built up, cracks in furnaces and flues made good, etc. Boiler repairs can be executed to the satisfaction of Lloyds, B.O.T., and insurance companies' inspectors.

Tilling-Stevens also manufacture complete portable and fixed welding plants. The mobile form of plant can be supplied with lorry type body, or an additional equipment can be carried on platform of chassis, enabling two arcs to be supplied. A large number of equipments have been supplied for use in connection with repairs to ships, marine and land boilers.

Up to the present electric arc welding has not been very extensively adopted for manufacturing purposes, but there is no doubt in the course of the next few years electric welding will supersede a large number of manufacturing operations. Its use in the form provided by the mobile arc welding equipment marks a great advance, just as is the case with the use of the Tilling-Stevens vehicles by the Admiralty and the War Office for providing a mobile form of searchlight equipment. This has been operated not only in this country and the near theatres of war, but in the distant operations against the Germans in South-West Africa.

## KARRIER 5-TON CHASSIS.

In view of the interest created by the latest product of the Karrier Motor Vehicle Works of Messrs. Clayton and Company, of Huddersfield, we reproduce (page 191) illustrations of the chassis, which is that of the 50-H.P. 5-ton industrial vehicle, type B.R. 110. It embraces many improvements, the most important being three-point engine suspension, improved and more convenient control levers for gear changing, brakes, and throttle and magneto control; more convenient and better brake adjustment, and front and rear springs of improved design.

The B.R. 110 chassis is admirably designed for general heavy haulage, such, for instance, as that of the cotton trade and the textile industries. The high standard of quality and workmanship throughout is worthy of Karrier engineering. The 50-H.P. engine (the largest engine fitted for British War Office specification), and the useful range of speeds, deserve special mention, as being of great service and advantage in hilly country. The load capacity is 5½ tons gross, and assuming the body does not weigh more than half a ton (which is an ample estimate), then the net load can be safely taken as 5 tons—a useful and practical load in the class of work for which this chassis is recommended.

Subjoined are the particulars of the engine and chassis:—

*Details of Karrier 4-Cylinder Engine No. B.R. 110.*

| | |
|---|---|
| Horse-power (largest engine fitted for British War Office specification) ... ... ... ... ... | 50 |
| Bore ... ... ... ... ... ... ... | 5 in. |
| Stroke ... ... ... ... ... ... ... | 6 in. |
| Normal speed ... ... | 1,000 revolutions per minute. |
| Piston displacement ... ... | 7,722 cubic centimetres. 471·24 cubic inches. |

*Dimensions of Chassis.*

| | |
|---|---|
| From starting handle to towing hooks overall | 20 ft. 11¼ in. |
| From dash to rear end of chassis frame ... | 15 ft. 6 in. |
| From dash to centre of petrol tank ... ... | 2 ft. 11⅛ in. |
| From centre of petrol tank to rear end of chassis frame ... ... ... ... ... | 12 ft. 6⅞ in. |
| From dash to centre over back axle ... | 11 ft. |
| From ground to top of chassis frame ... | 2 ft. 10 in. |
| Back axle ... ... ... overall | 6 ft. 10¾ in. |
| Front axle ... ... ... overall | 7 ft. 2½ in. |
| Diameter of rear wheels (over tires) ... ... | 3 ft. 4 in. |
| Diameter of front wheels (over tires) ... ... | 3 ft. |
| Tires (rear wheels) ... ... ... | 160 × 881 (Twin). |
| Tires (front wheels) ... ... ... ... | 120 × 720 |
| Wheel track ... ... ... ... ... | 5 ft. 11 in. |
| Wheel base ... ... ... ... ... | 13 ft. 6 in. |

For some years the Karrier works have been turning out industrial vehicles of the highest quality and reliability; and to-day Karrier cars are doing yeoman service in every sphere of public and commercial work, as well as in the war areas. War conditions have proved the soundness of the design—strength and efficiency in every detail, phosphor bronze bushing of small parts, roller bearing transmission, accessibility, ample strength and proportion of all bearings, the evidence of careful workmanship in the finish of minor details, the efficiency of the cooling system that prevents overheating, and the flexible engine with power sufficient for its maximum load, and power to spare.

## MOTOR TRAFFIC ON BRIDGES.

As the result of a lawsuit, which was carried to the House of Lords, it was decided that railway companies are not liable to adapt their bridges to the requirements of heavy motor traffic. The Association of Municipal Corporations have requested their Law Committee to confer with the County Councils Association and with such other bodies and persons as they deem expedient, and to report what should be done in order that railway and other bridges (the weakness of which at present makes large sections of the highways useless for motor traffic) shall be reconstructed or strengthened in accordance with modern requirements.

## MANCHESTER TRANSPORT ORGANISATION.

At the request of the Ministry of Munitions, the Manchester Chamber of Commerce have formed a motor transport organisation at York Street, Manchester, in order to facilitate the speedy despatch of goods and to obtain return loads for motor lorries and steam wagons. The scheme will have the support of and co-operation of the Chambers of Commerce of Leeds, Bradford, Halifax, Huddersfield, Dewsbury, etc.

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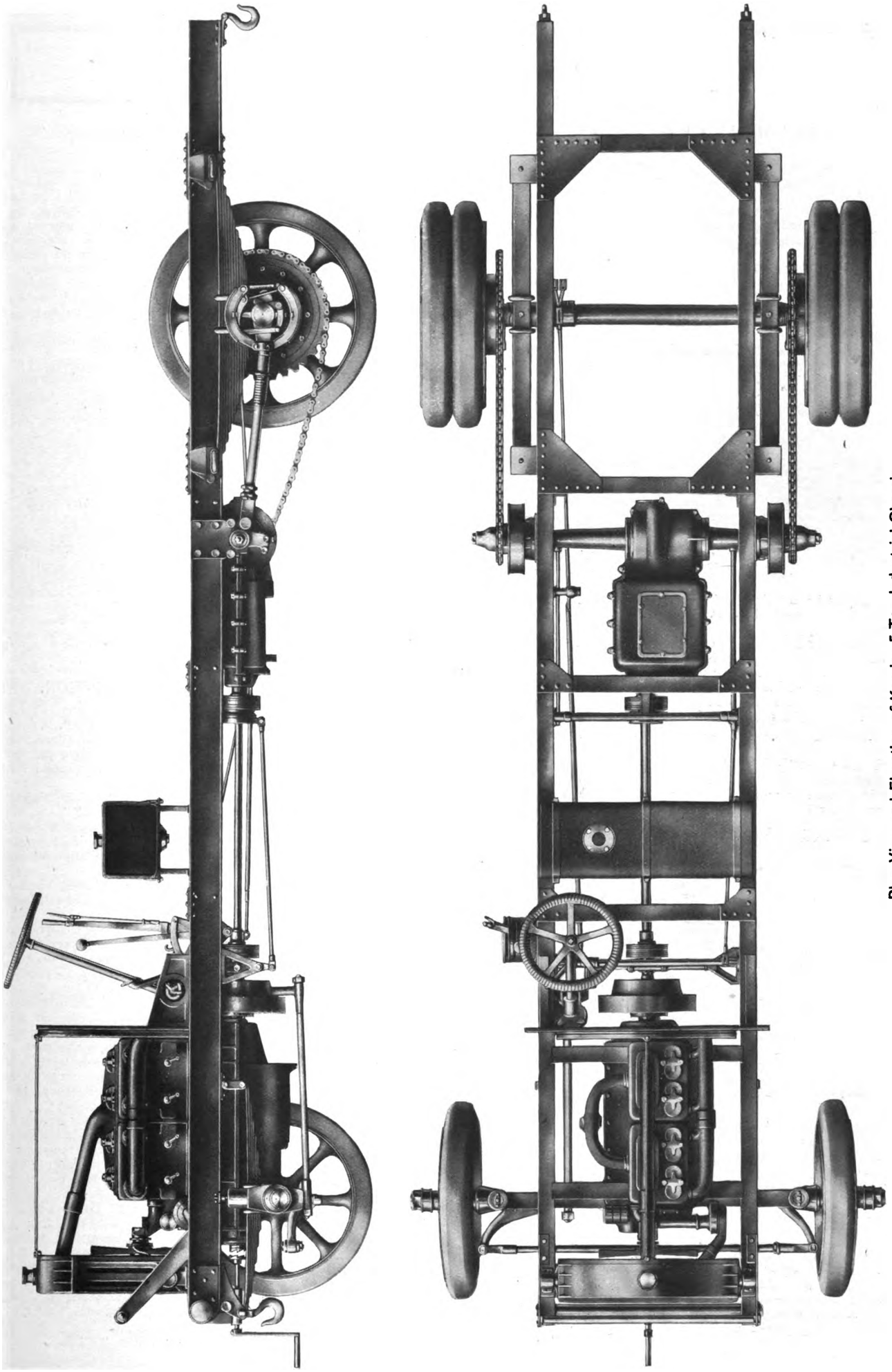

Plan View and Elevation of Karrier 5-Ton Industrial Chassis.

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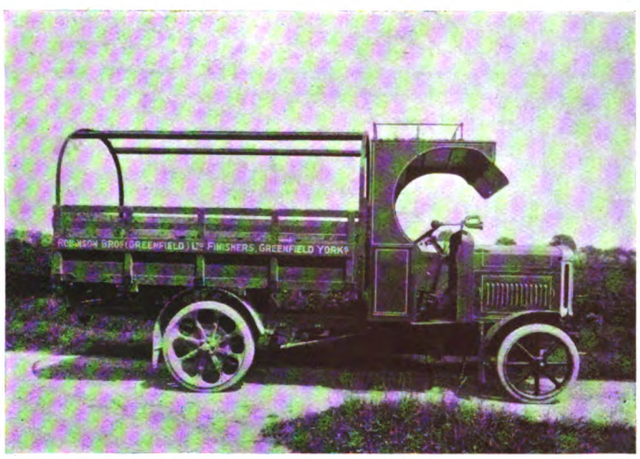
# MOTOR TRAFFIC.

## THE DEMAND FOR LEYLANDS.

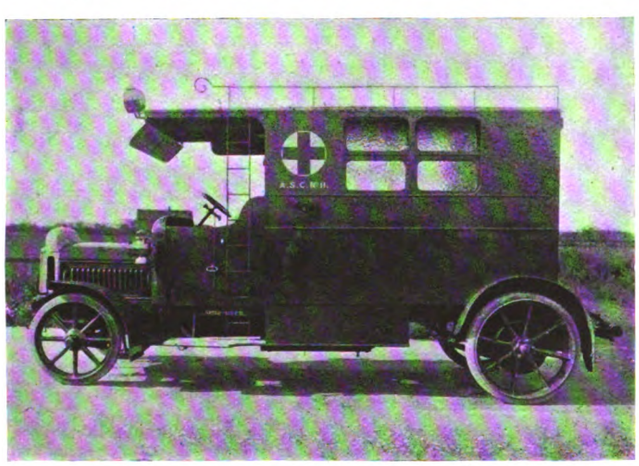
No firm of motor manufacturers has rendered greater service to the Empire during the war than Leyland Motors, Limited, of Leyland, Lancashire. In addition to supplying many hundreds of vehicles for military use in the various theatres of war, their products are largely adopted by firms engaged on munition work and in other spheres of national importance. Leyland Motors, Limited, are also



**Leyland "B" Type, War Department Subsidy Model in Service in France.**

prominent as manufacturers of motor fire engines, the demand for which has been abnormal during the war, on account of the erection of so many national munition factories and also in order to combat conflagrations that may result from air raids.

A chassis in great demand is that with an engine developing 22-28 H.P., "B" type, with a carrying capacity of 2½ tons. This has long been a popular War Department subsidy model, and one



**Leyland Ambulance, "B" Type, War Department.**

of the appended illustrations shows a lorry which was in the service of a Yorkshire firm, but was impressed for service in France.

The same horse-power applied to ambulance vehicles of the "B" War Department type has resulted in a conveyance admirably adapted for such important work, even when only solid tires are provided. A very large number of this class is in war use, thus saving the expense of and giving greater reliability than pneumatic tires.

WILTSHIRE COUNTY COUNCIL AND NEW OMNIBUS ROUTES.—The County Council of Wiltshire have decided that all consents given under Section 20 of the Local Government (Emergency Provisions) Act, 1916, to the establishment of new omnibus routes shall be upon condition of a payment of 2d. for every mile travelled.

## UNITED KINGDOM PETROLEUM.

THE CROWN TO HAVE EXCLUSIVE RIGHTS.

Mr. Walter Long, the Colonial Secretary, introduced in the Commons on August 18 a Bill, which will no doubt be passed after the recess, giving the Government power to bore for oil within the United Kingdom and develop home supplies which are believed to exist but which cannot be easily located by private enterprise. To leave petroleum to the scramble of competition would result, said Mr. Long, in extravagance and waste as in other countries.

It provides that the Crown shall have the exclusive right of getting petroleum within the United Kingdom, and if any person without a licence gets petroleum he shall forfeit a sum equal to three times the value of any petroleum gotten by him.

There shall be paid into a special fund called the petroleum royalties fund

(a) In respect of petroleum gotten on behalf of His Majesty, out of moneys provided by Parliament; and

(b) In respect of petroleum gotten by a person holding a licence under this Act by the licensee, a sum equal to 9d. for every ton of petroleum so gotten.

Where operations for the getting of petroleum are commenced in any district, the Board of Trade shall prepare a scheme defining the area the persons interested in the land in which are entitled to receive payments. A penalty of three months' imprisonment or a fine of £50, or both, is provided for any person, or, if a company, every director and officer of the company, who refuses to give the necessary information required or gives false information.

The Board of Trade may search and bore for and get petroleum, and may grant licences for such consideration as the Board think fit.

The sum payable into the petroleum royalties fund in respect of natural gas shall be a sum equal to 1d. for every 10,000 cubic feet of the gas computed on the basis of volume at the barometric pressure of 30 inches of mercury and a temperature of 60 deg. Fahrenheit.

## FREEDOM FROM ACCIDENT COMPETITION.

At the last meeting of the London Safety First Council, held at the Middlesex Guildhall, Westminster, the Council adopted a recommendation by the Drivers' Educational Committee for the promotion of a Freedom from Accidents Competition upon the following conditions:—

(1) The competition is to be known as the "London 'Safety First' Freedom from Accidents Competition."

(2) The object of the competition is to encourage, by the award of money prizes and badges of merit, drivers of all classes of vehicles to exercise every care and discretion in the performance of their duties.

(3) The competition will be divided into three classes, viz.:—(1) Drivers of motor vehicles; (2) drivers of horsed vehicles; (3) drivers of tramcars.

(4) Thirty prizes of 10s. each, together with a first-class badge of merit, and fifty second-class badges of merit, are offered in each of three classes, to drivers whose records, in the opinion of the council, qualify them to receive such awards.

(5) All drivers continuously employed for the period of twelve months from October 1, 1917, by one or more of the corporations or firms operating in the Greater London area will be eligible to compete in their respective classes, and intending competitors should at once notify their employers of their desire to take part in the competition.

(6) The competition will commence on October 1, 1917, and terminate on September 30, 1918.

(7) Employers must, not later than Tuesday, October 22, 1918, send to the honorary secretaries of the London "Safety First" Council, a duly certified return giving the names and addresses of those of their employees who, during the twelve months ending September 30, 1918, had been free from accidents.

(8) The decision of the London "Safety First" Council on all matters affecting this competition is to be final and binding.

On the recommendation of the Publicity Committee it was agreed to make application to the education authorities in the Greater London area for permission to promote a competition among scholars attending elementary schools, and to award prizes for essays on "Safety First" written by school children. The committee also reported having issued a poster dealing with "safety" advice for pedestrians.

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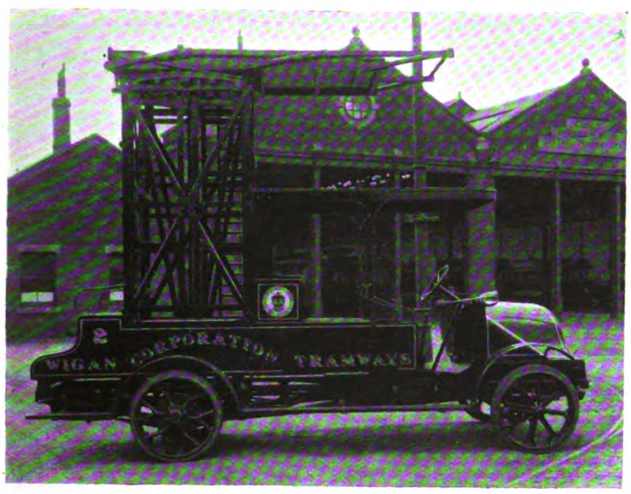
# MOTOR TRAFFIC.

## AUSTIN CHASSIS WITH TOWER WAGON.

The photograph reproduced on this page illustrates an Austin 2-3 ton chassis, fitted as a tower wagon, which was recently supplied by Mr. H. H. Timberlake, of Wigan, to the Wigan Corporation Tramways Department. The body was specially designed by Mr. Frank Buckley, tramways general manager, and it was built by Messrs. Rawlinson, of Blackburn.



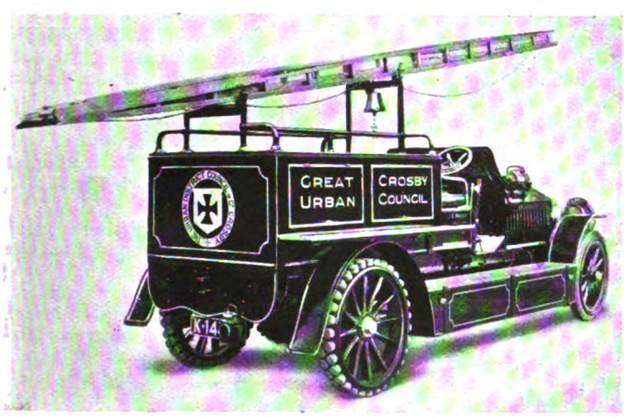

**Austin Chassis Fitted as Tower Wagon.**

Numerous tramway undertakings have found that one or more motor tower wagons are indispensable, not only in emergencies that arise in the course of tramway traffic but for the transport of materials and for the execution of ordinary overhead and other repairs. The additional security and convenience resulting from the use of a motor tower wagon compensates in a very short time for the outlay incurred.

## ADAPTABILITY OF THE NAPIER.

The subjoined photograph shows a transformed old type Napier, adapted as a fire engine vehicle, supplied to the Great Crosby Urban Council by Messrs. D. Napier and Son, Limited, 14, New Burlington Street, W.

The chassis is nine years old, and had been in use as a touring car for that period, giving complete satisfaction. It was then purchased




by Messrs. C. W. Donkin and Company, Limited, Liverpool, stripped, and the present body fitted. It is now being used in the capacity of a fire engine tender.

It is obvious that under war conditions new chassis cannot be supplied for public use, and our illustration shows how an old chassis of reliable make can be adapted to modern requirements. The service which this vehicle has been put to during its nine years of life is certainly a tribute to British workmanship.

## MOTOR VEHICLES FOR MUNICIPALITIES.

WIDNES COUNCIL have purchased a 5-ton motor wagon.

BINGLEY COUNCIL are likely to purchase a steam wagon.

SHREWSBURY COUNCIL are purchasing a motor fire engine.

BRADFORD CITY COUNCIL have purchased a motor tractor.

WEYMOUTH COUNCIL propose to acquire a battery vehicle.

KINGSWOOD URBAN COUNCIL have decided to purchase a motor fire engine.

GRIMSBY COUNCIL are purchasing another motor ambulance for the sanatorium.

BATH CORPORATION have under consideration the purchase of another motor lorry.

BARROW-IN-FURNESS COUNCIL are purchasing a motor fire engine and a motor ambulance.

LEEDS TRAMWAYS COMMITTEE are obtaining two steam wagons at a cost not exceeding £1,600.

LITTLEHAMPTON COUNCIL have formed a committee to raise funds for the purchase of a motor ambulance.

WEST HAM COUNCIL are obtaining two motor ambulances, at £650, from Messrs. Wilson and Stockall.

THORNABY COUNCIL have instructed the surveyor to obtain tenders for the supply of a motor fire engine.

DARLINGTON CORPORATION have decided to purchase a motor wagon for use in the Highways Department.

ROCHDALE CORPORATION have adopted a report by the Cleansing Committee in favour of obtaining motor vehicles.

MANSFIELD COUNCIL have approved of the purchase of an electric tip wagon from the General Vehicle Company at £1,070.

BIRMINGHAM CORPORATION have granted powers to a private company to operate a number of gas-driven motor omnibuses.

EAST HAM COUNCIL are obtaining information from Sheffield and other municipalities as to their experience with electric dust vans.

STRETFORD URBAN COUNCIL have under consideration a report recommending the use of steam wagons for the collection of house refuse.

SOUTHEND CORPORATION have decided to purchase four 2-ton "Orwell" electric tipping wagons, fitted with "Ironclad Oxide" batteries.

HUDDERSFIELD COUNCIL have failed to secure the sanction of the Local Government Board to acquire electric wagons by means of a loan.

CAMBRIDGE CORPORATION are considering a report from the Fire Brigade Committee recommending the purchase of a motor fire engine.

JOHANNESBURG COUNCIL have purchased a motor cycle and side car with electric light outfit for £139, for the use of the electricity department.

DEWSBURY ELECTRICITY AND TRAMWAYS COMMITTEE have placed a contract with Mossay and Company for a battery propelled wagon, at £911.

YORK TRAMWAYS COMMITTEE have received the sanction of the Treasury to borrow £1,300 for the provision of another battery propelled omnibus.

HALIFAX CORPORATION have given instructions to the borough surveyor to make inquiries with a view to the purchase of a second-hand tipping wagon.

CONSETT URBAN COUNCIL have decided to fit up a petrol van, used for the collection of house refuse, with coal gas equipment for experimental purposes.

MARYLEBONE COUNCIL have ordered four additional motor vans, for dust conveyance, from the Austin Motor Company, at an estimated cost of £745 each.

KETTERING URBAN COUNCIL have received a 3½-ton battery tipping wagon from the General Vehicle Company. It is to be used for the conveyance of coal.

SALFORD CORPORATION have approved of the recommendation of the Gas Committee for the purchase of a motor wagon for distributing coal to householders.

SALFORD ELECTRICITY COMMITTEE has accepted Messrs. Mann's Patent Steam Cart and Wagon Company's tender for the supply of a 5-ton tipping wagon at a cost of £850.

OKEHAMPTON RURAL COUNCIL are inquiring as to the possibility of purchasing a motor lorry for the haulage of stone, owing to the difficulty experienced in hiring horses and men.

WALTHAMSTOW URBAN COUNCIL have decided to purchase a 5-ton steam wagon for use in the Highways Department, replacing the 5-ton Clayton wagon taken by the Government.

BATH CORPORATION have instructed the electrical engineer to make inquiries with a view to the purchase of a motor lorry for taking away clinker and bringing coal from the colliery.

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# MOTOR TRAFFIC.

PORTSMOUTH COUNCIL have been informed by Foden's, Limited, that Government priority work will prevent them from delivering the two Foden steam vehicles now on order until December next.

ESSEX COUNTY COUNCIL have bought a second-hand 5-ton steam wagon, by Messrs. Clayton and Shuttleworth, from the Midland Rolling and Haulage Company, for the sum of £440, and a second-hand Aveling and Porter steam wagon at £400.

MANCHESTER CITY COUNCIL have sanctioned the purchase of motor vehicles as appended:—Tramways Committee, an additional parcels van from the Frances Motors, Limited; Fire Brigade Committee, motor fire engine and escape and motor fire engine; Baths and Washhouses Committee, Ford motor van for the conveyance of towels.

DEWSBURY GUARDIANS, desiring to purchase a motor vehicle for conveying patients to asylums and the sick poor to the Infirmary, asked the Local Government Board to sanction the purchase. In reply the Board stated that it was advisable to defer the proposal in view of the petrol difficulty. The Guardians, however, instructed their committee to continue their inquiries, and it was remarked that the time was opportune for purchasing one of the many private cars now standing idle.

## MOTOR TRAFFIC NOTES.

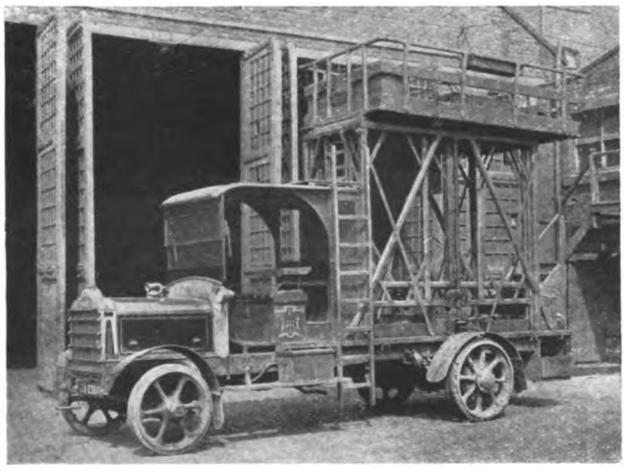
COAL GAS FOR CABS.—Early in August a motor cab propelled by coal gas was plying for hire in London.

THE FORD MOTOR COMPANY have presented one thousand motor ambulances to the American Red Cross Society.

PUBLIC TRACTION POWERS FOR LONDONDERRY.—The Corporation of Londonderry have decided to apply for powers to provide and work electric trolley vehicles, motor omnibuses, or electric cars.

LONDON MOTOR AMBULANCE SERVICE.—Since the institution in February, 1915, of the ambulance service of the London County Council, 11,649 calls have been attended to up to the end of the year 1916. In the first year the calls numbered 2,405, and in the second year 9,244. There are six stations and nine motor ambulances, including two spare vehicles.

SUGGESTED BY-LAWS FOR OMNIBUS TRAFFIC.—Sir W. Ryland Adkins, M.P., suggested, at a meeting of Northamptonshire County Council, that the Roads Committee should consider the question of framing by-laws for motor omnibus traffic. He asserted that some of the vehicles were overloaded, and were consequently dangerous, particularly in certain parts of the county where the roads were uneven.



**A Daimler Tower Wagon—Leeds City Tramways.**

A JAPANESE OMNIBUS SCHEME.—According to a report in the local newspapers forwarded from Tokio by H.M. Commissioner, application has been made to the city authority for sanction to a project for running 200 motor omnibuses. It is proposed that the vehicles shall be of small size owing to the narrowness of the streets, accommodation being provided for twenty passengers per omnibus. A company has also been formed with a capital of £51,000 for the conveyance of passengers by motor cars, and for selling and repairing cars.

WAR TRAFFIC AND ROAD WEAR.—Marylebone Council suggested to the quarterly meeting of the Metropolitan Boroughs Standing Joint Committee that they should make representations with a view to securing grants to local authorities by the Road Board for the purpose of repairing or relaying roads damaged by the abnormally heavy traffic of military and other vehicles due to the war. It was suggested that the grants should be made as soon as convenient after the cessation of hostilities. The matter was referred to the executive committee.

**45-h.p. 5-Ton Halley Lorry Supplied for Munition Work to a Glasgow Firm.**

NO COMPENSATION FOR IMPRESSED OMNIBUSES.—West Bridgford Urban Council have been informed by the Losses Commission that having regard to the terms of the warrant by virtue of which they acted, the Commission are unable to determine that any sums should be paid out of public funds in respect of the Council's claims for the impressment of their motor omnibuses early in the war. Acting on the advice of counsel, Mr. E. G. Palmer, the local authority have decided to proceed by mandamus to compel the Commissioners to make a report dealing with the case on its merits.

ELECTRIC VEHICLES.—The success of the electric vehicle in the municipal field has been largely due to its low running costs. For town work, where frequent stoppages are required, accumulator cars have been found to be thoroughly suitable, and the rapid development of this form of traction can be looked for just so soon as the Government control of labour and materials will permit. The recent increase in the price of petrol lends point to the suggestion of Messrs. Alan S. King and Company, of 28, Victoria Street, Westminster, in their advertisement in this issue, that motor users should be independent of petrol by the use of electric vehicles. Messrs. King are, we understand, in a position to supply electric vehicles to approved clients with quick delivery.

SOLID TIRE COMMITTEE.—Mr. F. A. Bonsor, of the Avon India-rubber Company, Limited, has been elected chairman of the Solid Tire Committee of the Society of Motor Manufacturers and Traders. The vacancy was caused by the retirement of Mr. W. H. Paull, of the Dunlop Rubber Company. Mr. Paull's long record of service has been recognised by the passing of a vote of thanks by the committee. Mr. Paull was one of the representatives of tire makers who recently visited France and presented a report to the War Office relative to tires.

LIEUT. F. ST. JOHN WHITE.—Although still suffering severely from the effects of the disablement which necessitated his being invalided from the service, it is gratifying to note that Lieut. Frederick St. John White, the Lacre Motor Car Company's publicity manager, is making a steady if somewhat slow recovery. His two years of active service do not, however, appear to have impaired his skill, and since he received his present appointment in January last he has introduced a new atmosphere of vigour and originality into the company's advertising. Mr. White has been closely associated with publicity work for the past twelve years, during which he has dealt with a variety of difficult advertising problems with notable success. He has for some years past been closely identified with railway and shipping circles, in which his journalistic abilities have been shown in the production of illustrated guide books and other travel literature. He served with the Queen's Royal West Surrey Regiment since the outbreak of war, being subsequently transferred to the Royal Fusiliers, and invalided last year with the permanent rank of Hon. Lieutenant.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

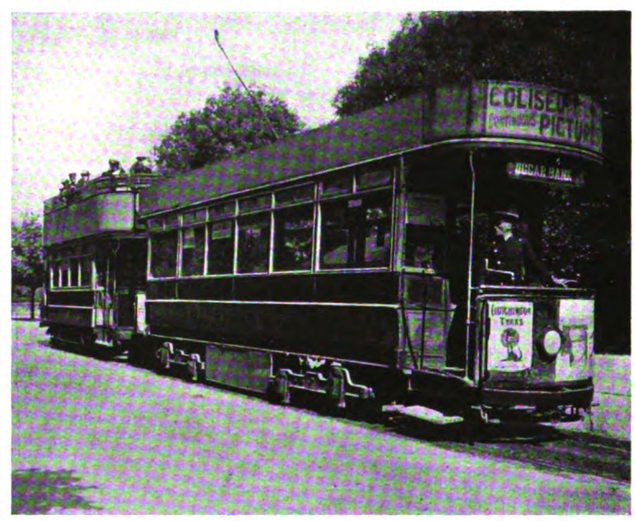
Founded 1892. LONDON, OCTOBER 18, 1917. VOL. XLII.

# PROGRESS IN THE USE OF TRAIL CARS.

BARROW ADOPTS TYPE OF CAR USED IN LONDON.

How great a disservice the Board of Trade did when for many years it discouraged the use of trail cars, has been felt since the war began as it never was before. If official opposition had been removed, as it should have been, many years ago, when the war broke out there would have been available for handling munition and other traffic a large supply of light cars; for tramway undertakings all over the country would have possessed themselves of trail cars for coping with emergency traffic. Such cars were comparatively cheap and the undertakings could have afforded to have a good supply of reserves. In the early days of electric traction trail cars were used to a small extent with very good results. In 1898, when the Kidderminster and Stourport tramway was electrified, that company, for instance, found trail cars an advantage, and there were a few similar examples. Subsequently, for what reason it is impossible to discover, the Board of Trade began to look unfavourably upon the idea, and at length refused to allow trail cars to be used. It is quite possible that certain consulting engineers, with little experience in tramway operation, were partly responsible for indoctrinating the officials with anti-trailer opinions. We once heard that a consultant, who certainly never was called upon to work out a schedule for a special service to meet the demands of the public on the occasion of a great football match, airily remarked "that it was much better to have each car a self-controlled unit; there was much less difficulty in adjusting the cars to the service." In these early days rigid economy was not regarded as necessary; electric traction was somehow to be so cheap that there would be ample margin, and all the motor cars wanted could, of course, be provided. To what conditions such anticipations led in London all the world now knows.

The police authorities in the metropolis naturally accepted the views of the Board of Trade with respect to trail cars, and for many years sternly opposed their use. As the pressure of enormous standing charges entailed by heavy expenditure on the conduit system began to be felt, the London County Council looked about for methods of economy, and gradually they were led to adopt the view often advocated in these columns that trail cars would be a great advantage to them.



Trail Cars at Barrow used for Munition Traffic.

They met, however, with opposition from all the authorities concerned. Alarming consequences were prognosticated by the police authorities, to whom the idea of two-coupled cars following one another on a rigid track in a London street was novel, and therefore to be resisted, just as every other tramway innovation has always been resisted by them. The Council, however, were undeterred, and in 1911 they decided upon a progressive movement and proposed to seek Parliamentary powers to run coupled or trailer cars.

The proposal was of importance because success would not only break down the barriers against trail cars in London, but it would alter the attitude of the Board of Trade and enable such cars to be used throughout the country. Letters were published in our columns during 1912 from leading managers in the United States and on the Continent, which revealed

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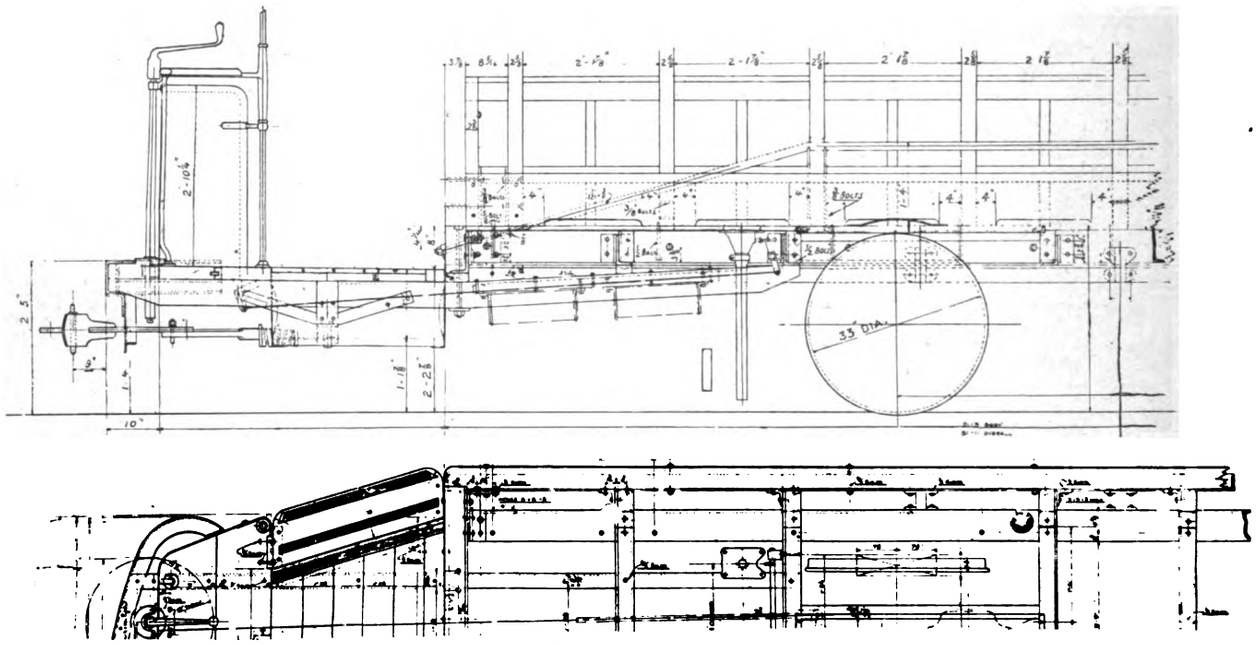
an overwhelming opinion in favour of using trail cars, and proved that they did not add to the danger of tramway operation. To quote only one example, Mons. A. Mariage, the well-known managing director of the Paris General Omnibus Company, remarked in the course of a cogent letter, "Our long experience of trail cars upon a line of heavy traffic and in crowded streets seems to us conclusive."

In due course the matter was fought out in Parliamentary committee rooms. During the contest the members listened to much adverse evidence by the police, but eventually the London County Council emerged with a partial victory. Trail cars could be used, but they were to be restricted to certain hours of the day. Naturally soon after the outbreak of war all barriers were removed, and the undertaking, as well as the public, have been greatly advantaged. It is unnecessary to add that none of the alarming consequences imagined by the police department have been realised.

Doubtless the example of the Council would have been followed in many other places if there had been no restrictions on the acquisition of additional rolling stock. As it is, a few other undertakings have made use of trail cars. Among them is the Barrow-in-Furness Tramway Company, whose cars are illustrated herewith. These cars are identical with the trailers now in use by the London County Council. Both inside and outside seats are ranged laterally, with an aisle between, so that all passengers may face in the direction in which the car is moving. The motor cars, which are of the single-deck type, are equipped with two Brush Company's 1,002 motors, each of 35 H.P. The trailers were built to the order of the company with the special object of meeting the exceptionally heavy munitions traffic, and they have proved an an immense boon at all times when traffic is at the peak.

There is little doubt that as soon as it becomes possible to obtain rolling stock, trail cars will come into common use throughout the country. To those who yet have any doubts as to the desirability of their advantage and safety, we recommend a perusal of the letters which appeared in our columns during 1912. Some of these were from the managers of tramways in Germany, but in electric traction, as in some other matters, we need not scorn to learn from the enemy.



Part Plan and Elevation of Trail Car, showing arrangement of Draw-Bar—Barrow-in-Furness Tramways.

## SHANGHAI TRAMWAYS SPECIAL WORK.

Supplementing the description of the Shanghai tramways which was published in our issue of September 13, 1917, we now give some additional details with regard to the track construction. The rails are of the British standard section 1, weighing 90 lb. per yard. The track has numerous passing places, and these and the junctions were all constructed on the ground. There are also many special junctions, all of which were constructed and supplied by Edgar Allen and Company, Limited, Imperial Steel Works, Sheffield, for both the English and the French concessions. The main line points and crossings for the English concession were supplied by the same firm, while Hadfields, Limited, of Sheffield, supplied those for the French concession.

On the English side there are 15 examples of special work varying in size, some of which are illustrated in the accompanying views. The largest piece of work, shown in Fig. 2, consisted of eight pairs of points and 28 crossings. Three of the centre crossings are in triple and five ways. Fig. 1 shows one of two triangles being put together on the ground. In Fig. 4 is illustrated a specimen of the double junctions. The layout for the car fan, comprising two pieces of six tracks, was constructed by Edgar Allen and Company, Limited, as will be seen in Fig. 5. A standard type of points and crossings was adopted for both English and French lines; those for the English concession being 12 ft. long and those for the French concession 10 ft. 6 in. long.

**Australian Tramways and Railways.**—An official report on means of transport and communications in Australia, which has recently been issued, shows that at the end of June last year the length of electric tramway lines in the Commonwealth was 406 miles and that no fewer than three gauges were employed, namely:—3 ft. 6 in., 75 miles; 4 ft. 8½ in., 326 miles; 5 ft. 3 in., 5 miles. There were also 102 miles of steam tramways, 46 miles of cable tramways, and 60 miles of horse tramways. There were 20,738 miles of Government railways and 1,149 miles of private railways open for traffic. The gauge variations (which are even more remarkable than in the case of tramways) and the length in miles of each gauge are as follow:—2 ft., 308 miles; 2 ft. 6 in., 122 miles; 3 ft. 6 in., 12,315 miles; 4 ft. 8½ in., 5,120 miles; 5 ft. 3 in., 5,041 miles. This total of 22,906 miles includes, as well as the two items given above, 1,019 miles of private railways used for special purposes.

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Fig. 1.—One of Two Triangles under Construction.

Fig. 3.—Laying Track with Passing Place in Narrow Street.

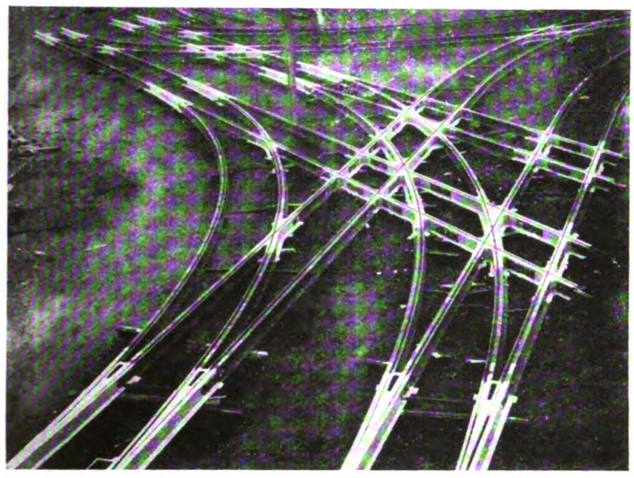

Fig. 2.—The Largest Piece of Special Work in Shanghai.

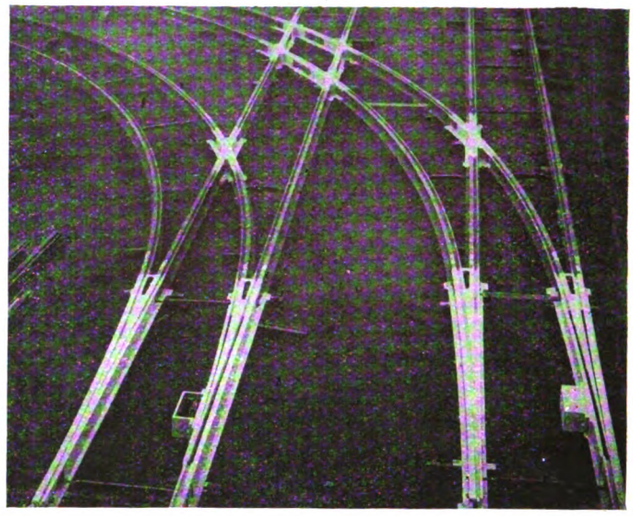

Fig. 4.—One of Numerous Double Junctions.

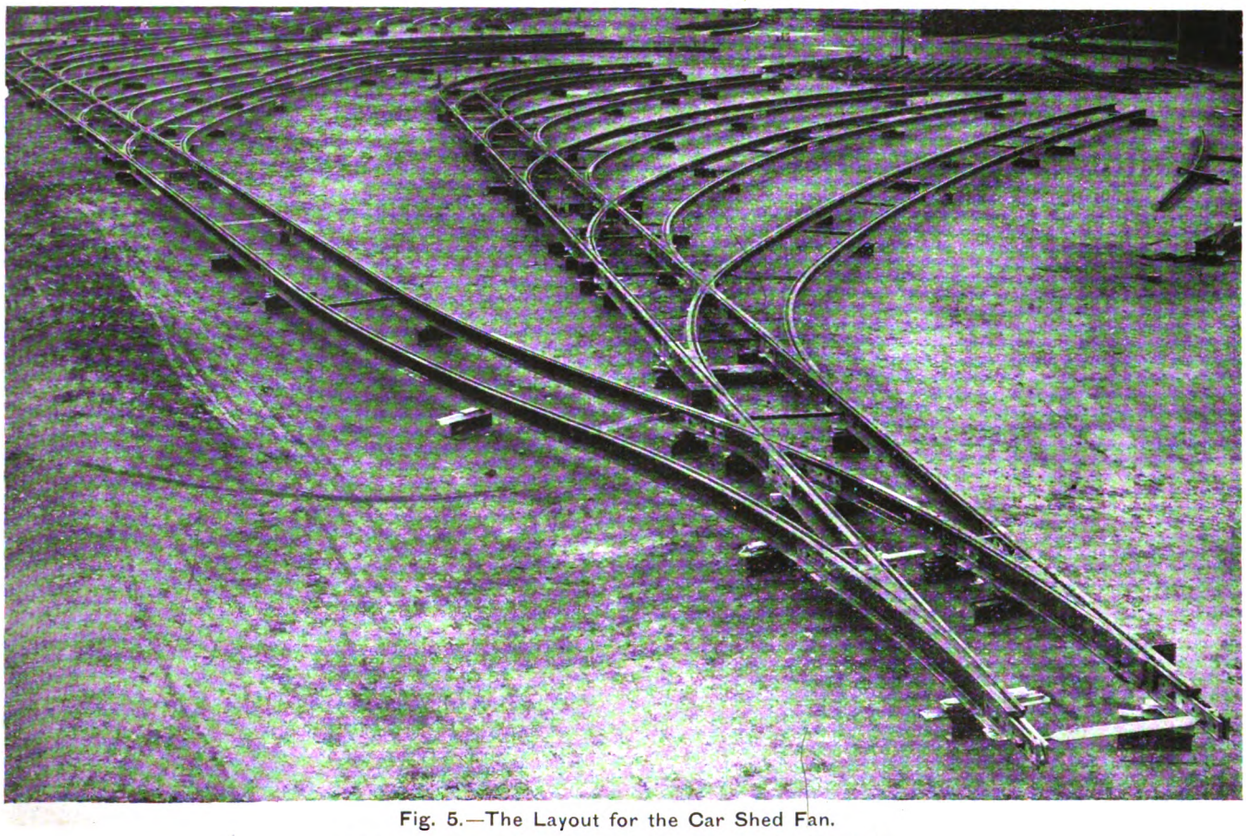

Fig. 5.—The Layout for the Car Shed Fan.

SPECIAL TRACK WORK—SHANGHAI TRAMWAYS.

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## SOUTHAMPTON'S ELECTRIC TIP WAGON.

About a year ago, on the advice of Mr. W. T. Robson, general manager and engineer of Southampton Corporation Tramways, a 2-ton Edison tip wagon was purchased, and Mr. Robson has now presented a detailed report of the work of this vehicle for the first 12 months, which shows that the machine has proved a success in every way. An accurate record has been kept, by means of weekly cost sheets, and these give the following totals :—

| | £ | s. | d. |
|---|---|---|---|
| Stores (including canopy and wind screen)... | 9 | 10 | 0 |
| Wages ... ... ... ... ... ... | 95 | 0 | 0 |
| Electricity ... ... ... ... ... | 53 | 4 | 1 |
| Cleaning and maintenance ... ... ... | 8 | 10 | 0 |
| Tires ... ... ... ... ... ... | 25 | 0 | 0 |
| Insurance ... ... ... ... ... | 7 | 4 | 0 |
| Spare parts (including new chains) ... | 7 | 11 | 9 |
| Depreciation (10 years' life) ... ... | 95 | 0 | 0 |
| | £300 | 19 | 10 |
| Deductions :— | | | |
| Income from other departments ... | 153 | 17 | 11 |
| Saving effected on contracts ... ... | 34 | 8 | 4 |
| Net cost of year's working ... | £112 | 13 | 7 |

The total weight of material carted amounted to 2,500 tons, including 1,300 tons of general tramway carting and 1,200 tons carting for other departments. As no records were kept of the work previously done by horses, the exact weight cannot be given, but it must have been considerably less, as it was always found necessary to engage additional horsing whenever scrap was carted away or reconstruction work was in progress. This additional expense should, of course, be added to the ordinary horsing cost, which for the 12 months before the tip wagon was purchased amounted to £412 10s. 6d. Deducting the income from hire to works department and from the sale of manure, £135 11s. 7d., the net cost of the year's working stands at £276 18s. 11d.

These figures, although showing a saving of over £164, do not, Mr. Robson adds, by any means denote the entire usefulness of this vehicle, which has taken the place of one of the tower wagon horses in towing a second tower wagon nearly every Sunday, in saving the cost of a large gang of men when moving rails, and by means of its extraordinary capacity for work has rendered unnecessary the need for additional horsing from outside. It has averaged nearly eight hours' work per day, has never been out of commission, and has given no trouble whatever.

The battery, which is the most expensive feature, has required no attention except to keep externally clean and for occasional filling up with distilled water, both operations taking only one hour per week. During the forthcoming year the liquid will probably require renewal at a cost of approximately £8, but otherwise Mr. Robson does not anticipate any further expense than is shown in the first year's costs.

Edison 2-ton Tip Wagon—Southampton Corporation Tramways.

## EDINBURGH TRAMWAY DEVELOPMENT.

Although the Corporation of Edinburgh decided last year that the conditions created by the war gave them no alternative but to postpone taking action on the consultants' report upon developing the city's tramways, circumstances appear likely to force earlier action in one direction. In consequence of the Admiralty having purchased an extensive area on the south side of the Firth of Forth, the Tramways Committee consider that it is necessary to ask for powers in the next session of Parliament to construct a line to South Queensferry, a matter that has been before them for three years. A motion for the Council to give notice to that effect has been accepted, and Councillor Harrison, chairman of the committee, informed the Corporation that they believed the extension would prove profitable, and that there were no engineering difficulties to be encountered. The burgh engineer has prepared a report on the two available routes, and Councillor Deas has a scheme for taking further advantage of the extension, which, he says, is going to vitalise the whole of the south of the Forth. He has given notice of a motion to consider an extension to Port Edgar, with a section between this line and the Leith Ferry Road tramway, and also between Seafield Links and Portobello. By adding these comparatively short lengths there will be a tramway extending from Port Edgar to Port Seton.

In his report on the questions of the route, the burgh engineer refers to route No. 1 by way of Dean Bridge, and route No. 2 by way of Comely Bank. In either case it is insisted that an essential to success

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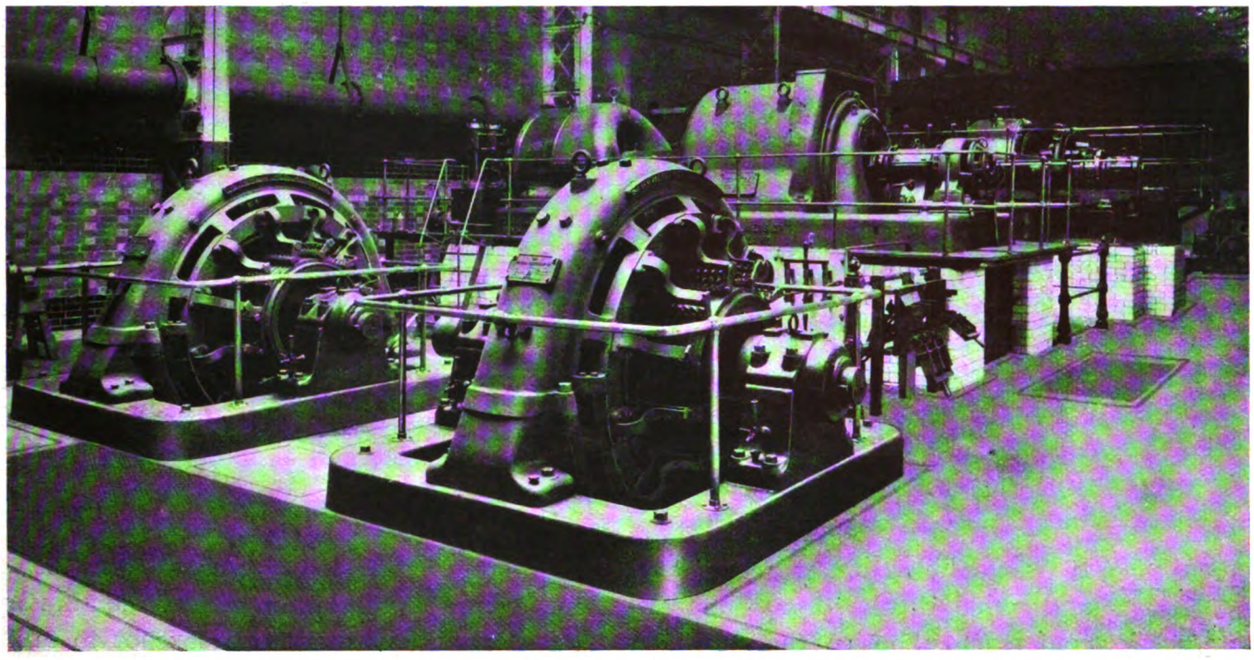
should be a through service from a convenient centre or terminus in the city to the terminus suggested at South Queensferry—the Hawes Pier. Route No. 1 starts from Hope Street, a terminus already authorised for tramways, thence along Queensferry Street, Dean Bridge, Queensferry Road, Blackhall, Davidson's Mains, Barnton, Cramond, Dalmeny, and onwards to Queensferry. Route No. 2 starts at the south end of Hanover Street, directly opposite the Mound, thence along Hanover Street, Queen Street (north side), and along the cable route to Stockbridge and Comely Bank, and thereafter continuing along the road towards Craigleith Station, whence its course to Queensferry would be identical with route No. 1.

Having regard to the advantages which both of these routes possess, it may be thought desirable that in any powers necessary to be obtained both should be included in the application. From Craigleith to Queensferry, these two routes, being on identical lines, are thence treated as one. As such the route may be either (1) partly on the road and partly on and through the fields, *ex adverso* of the road, or along the road for its entire length. The combination of road and field, it is pointed out, present much advantage. In this way those stretches of road such as along Cramond Bridge and parts westward therefrom in Linlithgowshire, against which objection might be taken by the County Council, are mainly avoided. Thereby a large capital sum is saved, and considerably increased speed is obtained. Convenient and frequent connections with the highway could be made. In the aggregate the measurements of road tramway and field tramway are: On route No. 1, *via* Dean Bridge, on road 3 miles, in fields 5 miles—total, 8 miles; route No. 2, *via* Comely Bank, on road $3\frac{5}{8}$ miles, in fields 5 miles—total, $8\frac{5}{8}$ miles. The system of traction recommended is overhead electric. The service suggested is every ten minutes for, say, 16 hours daily. Conditions which are indicated as making for the success of the undertaking are:—(1) The Rosyth Naval Base, now an accomplished fact; (2) the favourable attitude of the Admiralty to the Corporation; (3) the increase of motor traffic; (4) the near expiry of the cable tramway lease; and (5) the contribution of such a tramway to the city's commerce.

## GENERATION OF CONTINUOUS CURRENT BY TURBINES.

The practice of generating continuous current by the use of turbo-alternators coupled to rotary converters is rapidly extending, and one of the numerous installations of this description laid down by the General Electric Company, Limited, is shown in the accompanying illustration. This plant is installed in an important engineering works, and comprises a 1,500 KW. Witton turbo-alternator running at a speed of 3,000 revolutions per minute, and generating six-phase alternating current, which is delivered to two 750 KW. Witton rotary converters running at 600 revolutions per minute, and generating continuous current at 460 volts.



1,500-K.W. Witton Turbo-Alternator Coupled to two 750-K.W. Rotary Converters.

The installation has proved completely satisfactory, and has again demonstrated the utility of this method of generating continuous current, which enables the turbine to be run at a high speed of 3,000 revolutions per minute, by which the highest efficiency is attained, while at the same time the continuous current commutators on the converters can be designed with a peripheral speed consistent with satisfactory working.

In the background of the illustration a 750 KW. Witton continuous current turbo-generator set is seen which has now been running for over ten years. This type of machine is now superseded for the generation of continuous current by the combination described. The complete installation was laid down by the General Electric Company, Limited, of Witton, Birmingham, and Queen Victoria Street, E.C.4., whose leaflet (M. 4) gives full technical particulars of the arrangement and advantages of units of this description.

**The Morecambe Tramways**—the only horse traction undertaking owned by a municipality—are to be electrified as soon as Parliamentary powers can be obtained and the materials become available. The Council came to this decision at their September meeting, when it was agreed that the application should be for the adoption of electricity or some other form of mechanical traction. The undertaking was purchased from a company in 1908, but ten years before that date the Corporation had themselves constructed the Bare and East View section. Two Edison battery omnibuses are to be added to the existing small fleet of those vehicles as soon as possible.

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THE
# Tramway AND Railway World

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**An Industry without Driving Power.**

It is possible that the interest and value of the discussions at conferences of both of the tramway associations would be increased if the programmes were less ambitious. An effort is generally made to provide too many papers, and some of the papers cover far too much ground. As a consequence the discussions tend to become discursive. A little is said about a great many topics, and speakers wander over a field so wide that only a bird's-eye view can be taken of it. Papers of general range are, of course, desirable; but others might usefully deal with a specific problem that could be thoroughly discussed. In some cases a definite resolution might be proposed. The result would not be understood as committing the Association, but as expressing the opinion of those present after a discussion of the question. This practice was followed by the Continental Tramways Association, and it did, we think, enhance the interest and maintain the quality of the debates. In many cases it should be possible to obtain practical unanimity of opinion, and this would often facilitate improvements and reforms. Had the tramway conferences some years ago expressed, for instance, the view that trailer cars were desirable, it is scarcely probable that official resistance to the proposal would have persisted so long, and to-day municipal traffic difficulties would have been less than they are. In the tramway industry there are changes that urgently require to be made; they are generally admitted to be necessary and desirable, but there is no driving force sufficient to secure them. Now the tramway associations ought not to be content year after year to discuss these urgent claims; they should themselves act. Who will, if they do not? Supported by resolutions of the conferences, joint committees of both associations would be in a position to go to Government departments with the authority of those who know what is required in the public interest. When legislative action is needed the Board of Trade should be impelled to secure it. The President of the Board is himself a practical expert in the business of transport, and properly supported by the tramway industry his assistance could be counted upon to secure for it greater freedom to serve the public. There has never been a more favourable time; but what is the industry doing to take advantage of it except to talk? Why can we not have a real tramway congress, including all those who have the same interests, whether they be representatives of municipalities or companies, at which a progressive tramway programme could be drawn up and an agitation commenced that would secure greater scope for an industry on which, as the past three years have shown, the welfare of the public depends in no small measure.

**Development Prospects.**

Circumstances combine to favour plans for the development of inter-urban light railways, though of late years the legislative conditions attached thereto have mainly left the field to the omnibus. This, when privately owned, has only to secure the sanction of local authorities to be at once put in service. But last year's emergency legislation for the protection of the roads has placed that vehicle in difficulties as regards new routes, while many authorities are seeking to impose road charges before they renew existing licences. Wherever there is industrial activity due to the war inter-urban traffic has increased; around

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the numerous national munition factories towns have sprung up, covering in one instance an area of nine miles by three. In one county omnibus traffic has become so extensive that the chairman of the Highways Committee has suggested the construction of light railways alongside existing roads. Railway companies have been forced by the exigencies of the war to discourage short distance traffic. To atone for that shortcoming the manufacturers of motor vehicles, who can with difficulty maintain the output required by the Government, have been permitted to supply industrial and passenger conveyances. The difficulties of the railways should prove the tramway operators' opportunity. The paper on freight traffic presented at last year's Municipal Tramways Conference shows exactly how tramways stand in relation thereto. The outlook for freight conveyance will be improved for a considerable time after the war by the crippled condition of the railways. Further testimony as to the value of the transport of freight by the Leeds tramways was given at this year's conference by Alderman Spencer, as chairman of the company whose mineral traffic—of vital importance to the manufacture of munitions—is thus dealt with. The distance is five miles, and a portion of the track has been laid by the Corporation on private land. Fifty thousand tons of fireclay are dealt with per annum, to the financial advantage of both parties. The roads are relieved of the passage of one hundred horses and carts; it is impossible to obtain motor vehicles. Under the altered local and national circumstances opposition from railway companies may be regarded with less apprehension. Even before the war there were localities where they discouraged short distance passenger traffic, as in the Cardiff-Newport case, mentioned in Mr. Ellis's paper on "Tramways Development." Two other considerations should assist the inter-urban movement. Now that permanent recognition is likely to be given to the necessity of increasing the supply of home-grown food, a great rural revival may be anticipated. The allotments movement, and the carrying out of the great programme of urban and rural housing, are likely to add to the number of persons living further away from the towns. It is not surprising to find, in a forecast of the report of the Royal Commission on Housing in Scotland, that the Commissioners are likely to recommend the construction of wide highways to carry special tracks for high-speed tramways. This is the only adequate method for securing movement of the population to the outskirts. As a preliminary it would be well for tramway authorities to press the Reconstruction Committee for such amendments to tramway legislation as experience has shown to be necessary if enterprise is not to be handicapped and discouraged. There are other districts similar to that between Cardiff and Newport ripe for industrial and residential development, which require road transit to set the forces of progress in motion. The most difficult part of the problem will be encountered in considering what part light railways can play in securing intensive cultivation of the land, and in this matter the experience of Belgium should not be overlooked. When every aspect has been weighed rail traction will be found the most economical method both for urban and rural communication.

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**Work of The Municipal Association.**

At the Blackpool conference Mr. W. Murray at the close of his paper on "Special Fares" suggested that "to retain confidence and support the Association must devote less time to the consideration of purely academic, theoretical, or even technical questions, and bestow its thought and energies on matters of more prosaic but more pressing and general everyday interest." As a peroration the sentence is excellent, but it is not altogether in harmony with the facts. The author's paper itself is a tribute to the practical character of the Association's deliberations, and what could be more apposite to the requirements of the time than the presidential address of Mr. Mozley, the "Notes on Tramway Finance" by Messrs. Barnard, Holford, and Priestly, or the subject of Mr. Arthur Ellis's discourse on "Development of Tramways"? The same practical note was struck in the papers and reports presented at the two previous conferences held since the outbreak of war. The earlier proceedings reveal little or no ground upon which to base criticism. Nor did the remarks of any of this year's speakers indicate

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that Mr. Murray's view is shared by the membership. After all it is really the membership that moulds the programmes, and not the Council; every paper represents the respective author's view of current practice or requirements. If it may be said that there is one department deserving of greater attention it is that relating to technical matters, accompanied by research such as was carried out a few years ago in regard to brakes and in relation to car meters. The President hinted that there are arrears of technical matters waiting consideration, and now that it has been decided to resume the annual meeting of the managers' section it will be possible to deal with these subjects. It is to the managers and engineers that the Association must look for greater activity in regard to technical questions. Many important matters that have claimed attention locally owing to the war afforded good reason for the abandonment of the managers' gathering, but it now seems possible for the managers and their leading assistants to devote more attention to equipment and engineering problems. Possibly the troubles that the local staffs have had to encounter as a result of the war might be utilised for a joint paper or a report for next year's conference.

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**Economy in the Use of Coal.**

The chief points in the Coal Controller's appeal to central station engineers, at the Municipal Electrical Association's meeting, to effect further coal economies, were commented on in our issue of July 12. Attention was also called to the deliberations of the Board of Trade Electric Supply Committee as to permanent steps to be taken to facilitate and cheapen the supply of energy, with a view to aiding British industries after the war. While the proposals of the latter body have yet to be submitted, the interval has been used to good purpose by the Coal Controller. Mr. Calthrop is being locally aided in his difficult task by representative electrical engineers, and on September 26 he issued a memorandum embodying suggestions for effecting economy in coal consumption. Public services are affected by the proposals. The Controller proposes the curtailment of services entailing coal consumption, such as early and late car traffic, after consultation with the Ministries of Munitions and Labour, where munition and important work is likely to be affected. As far as the reduction of night services is concerned, this step will be a continuation of the practice widely adopted last winter consequent upon the strain entailed by the restricted lighting. Another step that the Controller advises will enable energy to be conserved for tramway and other essential services. He suggests application to the Board of Trade for sanction to disconnect non-essential consumers in case of urgent necessity; this authority to be obtained ready to be exercised when needed. Another idea is an arrangement with neighbouring towns to inter-connect distribution or generating plants by means of underground cables, or, in suitable cases, of temporary overhead wires over intervening country. This would enable one or two of the most economical stations in each district to supply several towns at light loads, and would also permit the various plants to shut down in turn during week-ends and holidays to effect repairs. It would provide, too, some amount of power as a stand-by in case of coal supplies giving out locally. While this course may not be easy of adoption where there are tramways, the difficulty experienced in obtaining fuel will doubtless secure its application to other towns. More than a year ago the necessity of preserving the power supply against the risks arising from aerial activity led a number of boroughs in the capital to adopt inter-connection. Their conversion to the scheme, which had been advocated long before the war, serves to accentuate their lack of foresight. The district conferences convened by the Board of Trade Committee were another factor in securing that result, and similar action has been agreed upon by many provincial authorities, including those with traction loads, as an after-war measure. The memorandum of the Coal Controller is intended to meet present necessities, and prompt consideration is being given to it. At Leeds the Corporation officials have met Mr. T. Roles, city electrical engineer of Bradford, and Yorkshire district representative of the Controller, and discussed schemes for a reduction in coal consumption on lines suggested in the memorandum.

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# The Municipal Tramways Association

(INCORPORATED)

## Sixteenth Annual Congress, held in Blackpool, September 20 and 21, 1917.

The success of the annual conferences has long been a tradition of the Municipal Tramways Association. That tradition originated in the success of the first conference in 1902, and up to the beginning of the war there had never been an annual meeting that in the opinion of some of those who attended was not "one of the best conferences the Association had ever held." Since the war the meetings have necessarily been of a somewhat different character. In 1914 the proceedings were limited to a formal business meeting, and in 1915 and 1916 the conferences were held in London, and were shorn of much of their general interest, although they were well attended, and provided papers and discussions that were of practical value, as they assisted committees and managers to form their opinions on certain points that were then of special importance. This year the council decided to revert to previous practice, and to hold the meeting in some other place than London. Mr. Mozley, the president of the year, naturally desired that the members should meet in Burnley, where he has been the successful tramway manager for many years, but in the absence of suitable accommodation there for such a large gathering he accepted the invitation of the Blackpool Tramways Committee, and the meeting was accordingly held in that popular resort. The meeting was confined to two days, and the time devoted to the work of the conference was the same as at the London meetings in the two preceding years. There were no excursions, and the Association arranged no extraneous attractions. The programme was, in fact, a severely simple one, wholly in keeping with the strenuous times in which we live. Nothing, indeed, was different from the London conferences except the place and the greater opportunity the members enjoyed of meeting one another after the work of the day was over.

In these circumstances there were some who thought the prospects for the conference somewhat doubtful, but the doubters were agreeably surprised. In attendance, in the interest of the discussions, and in its social aspects the conference in Blackpool was thoroughly successful. More than sixty municipal tramways were officially represented by delegates numbering from one to four each, and judging from the remarks made by many of them it may safely be concluded that none felt that their time had not been well spent. Those corporations who did not send delegates deprived themselves of an advantage, and their neglect to do so was a false economy of time and money. There is no virtue in that kind of Spartan denial, which is due to blindness to the best interests of the business that a tramway committee controls. The tramway industry is not parochial, and any undertaking which refuses to contribute its share to the general fund of experience will in the long run suffer for its narrowness of view. The annual conferences have often focussed and given driving force to changes that have proved of much benefit to the industry, and there is nothing else that could take their place.

From the opening of the conference to the conclusion the proceedings were marked by businesslike precision, but the programme was too long to enable full justice to be done to it. Many members who desired to speak on various points found no opportunity to do so, although the fullest use was made of the time available. Mr. Mozley proved an excellent president, and capably and unobtrusively managed the proceedings so that in spite of its length every subject on the programme was discussed. At the conclusion of the conference he was given a cordial vote of thanks for his services, and on all sides he received congratulations on a successful year of office. He is succeeded by Alderman S. Flint, chairman of Leicester Corporation Tramways Committee, who has long been a useful member of the Council. The new vice-president is Mr. T. B. Goodyer, general manager of Croydon Corporation Tramways, and a more popular appointment could not have been made.

When Mr. Mozley opened the conference on the Thursday morning, the Mayor of Blackpool (Mr. A. L. Parkinson) was present to welcome the members. Referring to the paper on fares which was about to be discussed, he alluded proudly to the fact that while some other tramway undertakings found it necessary to increase fares, Blackpool, in spite of increased expenses and war allowances, needed to make no changes. The financial success of the undertaking was conspicuous. The Mayor might have added that, unlike some other Corporations, they had not tried to achieve the impossible by granting unremunerative fares.

The conference then listened with interest to Mr. Mozley's presidential address. This bristled with debatable points, and were it not for the rule that the presidential address is never discussed, there would no doubt have been a lively interchange of views. Mr. Mozley's idea that sinking funds for municipal tramway undertakings are wrong will find many sympathisers in these days when the charge presses hardly on many undertakings; but his dictum that "tramways are ever growing in value" is based on the bold assumption that the future has no surprises in store. The question whether the periods usually fixed for repayment of loans are in need of readjustment might, however, well receive attention, particularly in view of the expansion of tramways that will come after the war. Useful, too, was the reference to standardisation of rolling stock. Much can be done in this way, but care must be taken not to check improvement. The president's views of the Tramways Act of 1870 will have the unanimous assent of all in any way familiar with tramway history in this country. Nothing more inimical to tramway development than the passing of that Act has ever taken place; and the suggestion that both the tramway associations should



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combine to urge its revision should lead to some practical step. The omens are not auspicious, but a strong effort ought to be made at once. The final suggestion of the address that the employees should in some way, as proposed in the Whitley report, be invited to share the responsibilities of committees and managers, will no doubt become a subject of consideration in the not far distant future.

On the motion of Alderman S. Flint, a vote of thanks was cordially given to the president for his address. In supporting the proposal, Mr. J. B. Hamilton alluded to the presence for the first time in the history of the Association of a number of ladies, who were present as representing women who in the existing emergency were now so largely employed on tramways.

The first paper, entitled "Some Notes on Tramway Finance," prepared by Mr. J. Barnard, Mr. F. Priestly and Mr. G. W. Holford, was presented by the latter. It was a practical discussion of a number of points, on many of which a long debate might well have taken place; and the authors had some reason for complaint that the discussion went outside even the wide range of topics they had touched upon. We had, however, an able address from Alderman C. F. Spencer, chairman of Halifax Tramways Committee, who opened the discussion, and very capably dealt with the financial problems affecting not only tramways but local authorities and the nation. Alderman Spencer's remarks will be found in full in our report, and we bespeak for them the study of everyone interested—and who is not—in the problems that confront government with respect to finance in the unprecedented conditions that now exist. Mr. Arthur Ellis, engineer and general manager of Cardiff tramways; Alderman R. T. Fletcher, Wigan; Bailie W. W. Montgomery, Glasgow; Councillor R. J. Bishop, Walthamstow; Mr. William Murray, manager Walthamstow tramways; and Councillor Fryer, Birmingham, took part in the discussion that followed.

Among the guests present was Mr. W. G. T. Goodman, chief engineer and general manager of Adelaide Municipal Tramways Trust, who is visiting this country on official business, and on the invitation of the president he made a very interesting and pertinent contribution to the debate. Confining his remarks to subjects dealt with in the paper, he gave much useful information with regard to such matters in Australia, and he was listened to with close attention.

The next subject was "The Rule of the Footpath." This was to have been introduced by Mr. James Dalrymple, general manager of Glasgow Corporation Tramways, but owing to the King's visit to Glasgow he was unable to be present. In his absence Bailie W. W. Montgomery, convener of Glasgow Tramway Committee, read Mr. Dalrymple's notes advocating the adoption of the rule that pedestrians should keep to the left side of the footpath, instead of to the right, because of the increased safety that would thus be secured.

Mr. H. E. Blain, operating manager of the London General Omnibus Company, a former president of the Association, strongly supported the change, and said that three-fourths of the fatal accident claims with which his company had to deal would be avoided if pedestrians would keep to the left. He also made the notable statement that the safety first campaign was saving his company £50,000 a year in the payment of damages. How much saving in human suffering that fact represents can hardly be over-estimated. Councillor T. Canby, Huddersfield, said that the matter was one of national importance, and if the new rule were adopted it would be of great benefit.

Sir John Courtis, chairman of the Cardiff Corporation Tramways, proposed that the Home Office should be approached in the matter, and he was supported by Mr. H. W. Scott, Highways Committee, London County Council; Alderman C. F. Spencer, of Halifax; Councillor Bishop, of Walthamstow; and Councillor Heap, of Burnley. The discussion was concluded by the adoption of a resolution that the Home Office and the various local authorities should be urged to take action in the matter.

Mr. William Murray, manager Walthamstow Tramways, then briefly introduced his paper on the "Differentiation in Fares for Workmen and other Passengers on Tramways." The paper is a careful study of the question, and expresses views with which many will thoroughly agree, and it met with a cordial reception. Councillor J. Moon, deputy chairman, Plymouth Corporation Tramways, opened the discussion, and he was followed by Alderman Broadley, Halifax; Mr. W. J. McCombe, tramway manager, Hull; Mr. William Clough, general manager, Bury Corporation Tramways; Mr. Arthur Ellis, general manager, Cardiff Corporation Tramways; Councillor A. J. Bishop, Walthamstow; Mr. V. Fisher, general manager, Dundee Corporation Tramways; and Mr. W. J. Squires, London County Council, who said that he did not think halfpenny fares would come back in London. In his reply, Mr. Murray remarked that since Walthamstow had abolished halfpenny fares and substantially increased workmen's fares their traffic receipts had increased fully 2d. per car-mile.

A discussion on "The Development of Tramways" was opened by Mr. Arthur Ellis, city electrical engineer and tramways manager of Cardiff. Mr. Ellis looked forward to a great expansion of tramway facilities after the war, and insisted on the necessity of providing transit in suburban and rural districts so that people who lived off the main roads could reach the centres. Parliamentary procedure for obtaining powers for tramway extensions should, he urged, be simplified.

Mr. A. R. Fearnley, general manager, Sheffield Corporation Tramways, referred to the motor omnibus for the development of rural traffic. In Sheffield they had built up an omnibus traffic of 6,000,000 passengers per annum, with receipts amounting to £40,000. There was much to be done in encouraging the riding habit, and through-running and the inter-connection of systems were of great service to that end. Mr. N. J. Young, general manager, Newport Corporation Tramways, thought the time had come for the consideration of town planning and tramway development as part of a combined scheme. Alderman W. C. Fenton, vice-chairman, Sheffield Tramways Committee, said he believed in the American view that the provision of tramways brought population, and he urged a bold policy in tramway enterprise.

Mr. A. Baker, general manager, Birmingham Corporation Tramways, characterised the present method of Parliamentary control over schemes of local authorities as simply monstrous. Some less costly procedure ought to be possible. Alderman Spencer, of Halifax, alluded to the vital importance of goods traffic for tramways, both from a local and national point of view, and gave some important figures regarding goods haulage on Leeds tramways. Mr. A. H. Scott, London, spoke of the advantage that would result if agricultural products could be brought direct to markets by tramways. Mr. Ellis briefly replied to the discussion.

On Friday morning a meeting of the Executive Council was held, followed by a meeting of the Managers' Section, at which it was unanimously agreed to resume the managers' spring meetings, and that the next meeting should be held at Birmingham. Then followed an extraordinary general meeting to confirm

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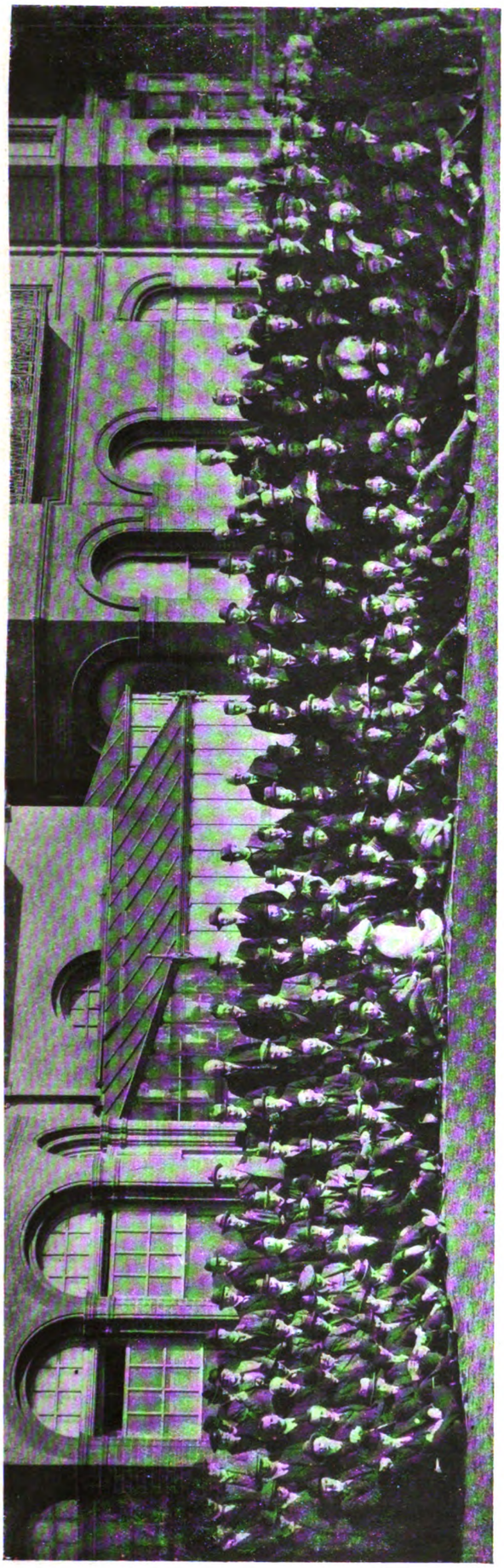

Municipal Tramways Association Conference at Blackpool.

certain alterations to the articles of association, of which particulars will be found in the full report which is given in the following pages. The most notable change provides for the appointment by the Council of a chairman of the Council who shall hold office for a year. This is a change that will undoubtedly be found a decided advantage. It will relieve the president from much work that can as well be performed by a chairman, and that in the case of a busy member of a Town Council might prevent his acceptance of the position.

At the annual general meeting a letter was read from Bailie Buist, convener of Dundee Tramways, inviting the Association to visit Dundee, an invitation that had been made during Mr. Peter Fisher's presidency of the Association. The letter was cordially received, and was referred to the Council.

The annual report, which will be found elsewhere in this issue, was adopted. It is a gratifying record of work done by the Council in a time of great stress and difficulty; and the Association is deeply indebted to the members who have found time, often at great personal inconvenience to themselves, to devote to matters which concern every municipal tramway in the country. Many, indeed, concern all tramway undertakings, and it is pleasant to note that the Municipal Tramways Association and the Tramways and Light Railways Association are working harmoniously together in all matters of common interest.

In their report the Council mentioned that Mr. C. J. Spencer, who had filled the position of hon. sec. for the past five and a half years, had, owing to the demands of Government work, been obliged to resign that position. Mr. A. R. Fearnley, who had occupied the position before Mr. Spencer, had resumed the duties *pro tem.*

The election of officers then took place. As previously mentioned, Alderman S. Flint, chairman Leicester Corporation Tramways, was elected president, and Mr. T. B. Goodyer, manager, Croydon Corporation Tramways, vice-president.

The following were elected members of the Council. Mr. A. Baker, general manager, Birmingham, Mr. J. M. McElroy, general manager, Manchester, Alderman R. Wood, chairman of the Stalybridge, etc., Tramways and Electricity Board, Councillor R. Mayne, J.P., chairman of Newcastle Tramways Committee, and Alderman C. F. Spencer, chairman of Halifax Tramways Committee.

The following are, therefore, the officers of the Association for the ensuing year:—

PRESIDENT.
Alderman S. Flint, J.P., Leicester.
VICE-PRESIDENT.
T. B. Goodyer, Croydon.
PAST PRESIDENTS.
H. Mozley, Burnley; P. Fisher, Dundee; Ald. H. Linsley, Salford.
COUNCIL.
A. Baker, Birmingham.
Wm. Clough, Bury.
Alderman Sir J. W. Courtis, Cardiff.
Jas. Dalrymple, Glasgow.
A. L. C. Fell, London.
J. B. Hamilton, Leeds.
Councillor E. Heap, Burnley.
G. W. Holford, Salford.
Councillor R. Mayne, Newcastle.
W. J. McCombe, Hull.
J. M. McElroy, Manchester.
Alderman C. F. Spencer, Halifax.
Alderman R. Wood, Stalybridge.
A. F. Lucas.
HON. SOLICITORS.
E. R. Pickmere, Town Clerk, Liverpool.
S. F. James, Town Clerk, Ilkeston.
HON. TREASURER.
C. J. Spencer,
General Manager, Bradford Corporation Tramways.
HON. SECRETARY.
A. R. Fearnley,
General Manager, Sheffield Corporation Tramways.

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A cordial vote of thanks was passed to the retiring president, Mr. Mozley. On the motion of Alderman Dunsford, chairman of Southampton Corporation Tramways, the conference passed a resolution expressing the thanks of the Association to the Blackpool Corporation, the Mayor, the chairman and members of the Blackpool Tramways Committee, Mr. Charles Furness (the general manager and engineer, Blackpool Corporation Tramways), Mr. John Cameron (manager of the Blackpool and Fleetwood Tramroad Company), and Mr. H. W. Laing (manager of the Blackpool, St. Anne's and Lytham Tramways Company) for the facilities and hospitality that had been accorded to the conference. Mr. Furness made a brief but happy reply, and the proceedings were shortly concluded.

The members of the conference were afterwards entertained to luncheon at the Metropole Hotel by the Blackpool Corporation, and subsequently a photograph of the company was taken in the grounds of the hotel.

arrangements were made with that usual attention to detail that the hon. secretaries and their assistant, Mr. F. W. Falkingham, have taught the members unquestioningly to expect. Much of the success of the annual meetings is due to the thoughtful arrangements that are always made, and the votes of thanks to those responsible for the plans were more than mere formal expressions.

The absence of two well-known and popular members of the Council was much regretted. Both Mr. J. M. McElroy and Mr. C. J. Spencer were detained by their duties in connection with their Admiralty appointments, and fitting references to them were made by the president. Both of them are among the original members of the Association, and this was the first conference at which they have not bene present. Mr. McElroy was re-elected to the Council, and Mr. C. J. Spencer was elected hon. treasurer, so that he remains *ex-officio* a member of the Council.

**Cross-Bench Open Cars—Blackpool Corporation Tramways.**

In the afternoon a visit was paid to St. Anne's in special cars, many of them of the cross-seat open type which Mr. Furness has used to such excellent advantage for "circular tours." A large number of these cars are in regular service, and they are greatly appreciated by the public. As the photograph indicates, the cars provide a handsome revenue for the department, the average earnings being more than 3s. per car mile. The fine new gardens and spacious open-air baths at St. Anne's were inspected, and tea was served at the latter, where the visitors witnessed an exhibition of the efficiency attained in the art of swimming and high diving by several well-known tramway managers. During their visit to Blackpool the delegates were provided with passes on all the tramways in the district, and many other hospitable arrangements were made for their comfort and entertainment. The hotel accommodation was ample, and the majority of the members were able to find rooms at the headquarters, the Savoy Hydro., the latest addition to Blackpool's hostelries. All

The pleasant impression of success which the conference created was enhanced, no doubt, by the agreeable weather which prevailed. Blackpool fully maintained its reputation for breeziness, but the bracing atmosphere was tempered by an agreeable mildness. Friday was a perfect day, and during the visit to St. Anne's the visitors were able to enjoy a sunset characteristic of Blackpool in the early autumn. The western light tinged with indescribable softness innumerable fleecy clouds floating high in a clear sky of deep blue, producing contrasts all the more charming because of their delicacy. Engagements called many elsewhere on the Saturday, but those who struggled through a crowded station could only hope that nature would continue her largesse to the genial band who remained over the week-end.

**Conference Photograph.**—Copies of the Conference photograph which is reproduced on the previous page may be obtained from Mr. R. W. Lord, 1, Chapel Street, Poulton-le-Fylde, at 4s. 6d. each.

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# LIST OF DELEGATES PRESENT AT THE MUNICIPAL TRAMWAYS CONFERENCE.

| | |
|---|---|
| Accrington... ... | Councillor T. Morley, vice-chairman.<br>H. Pilling, general manager. |
| Ashton-under-Lyne | Alderman R. S. Oldham, chairman.<br>Ernest Holt, general manager. |
| Belfast ... ... | Alderman J. Tyrrell, J.P., chairman.<br>J. S. D. Moffet, general manager. |
| Bexley ... ... | H. P. Stokes, general manager and engineer. |
| Birkenhead ... | Councillor H. Halsall, chairman.<br>C. Clarke, general manager. |
| Birmingham ... | Councillor H. Barrow, chairman.<br>Councillor J. Fryer.<br>A. Baker, general manager. |
| Blackburn ... ... | Councillor C. Higham, vice-chairman.<br>J. H. Cowell, general manager. |
| Blackpool ... ... | Councillor R. Holt, J.P., chairman.<br>Councillor H. Brooks, vice-chairman.<br>C. Furness, general manager. |
| Bolton ... ... | Councillor Peter Higson, chairman.<br>Councillor T. Shepherd, member of committee.<br>John Barnard, general manager. |
| Bradford ... ... | Councillor E. Priestley, J.P., chairman.<br>Councillor I. Akeroyd, vice-chairman.<br>J. W. Falkingham, assistant secretary M.T.A.<br>T. Stirk, traffic superintendent. |
| Burnley ... ... | Councillor E. Heap, chairman.<br>Councillor D. D. Irving, vice-chairman.<br>Henry Mozley, general manager. |
| Burton-on-Trent ... | A. B. Slater, general manager. |
| Bury ... ... | Alderman T. S. Collinge, J.P., chairman.<br>Councillor H. Hargreaves, vice-chairman.<br>William Clough, general manager. |
| Cardiff ... ... | Alderman Sir J. W. Courtis, J.P., chairman.<br>Arthur Ellis, engineer and manager. |
| Chester ... ... | W. H. Ellis, superintendent. |
| Chesterfield ... | R. L. Acland, general manager. |
| Colchester ... ... | Councillor A. M. Jarmin, chairman.<br>R. C. Bullough, manager and engineer. |
| Colne ... ... | T. G. Richardson, general manager. |
| Coventry ... ... | Councillor H. W. Wale, J.P., vice-chairman.<br>Councillor M. K. Pridmore, J.P., member of committee.<br>T. R. Whitehead, general manager and engineer. |
| Croydon ... ... | Alderman G. J. Allen, J.P., chairman.<br>T. B. Goodyer, manager. |
| Darlington ... | Alderman Sir Charles Starmer, chairman. |
| Darwen ... ... | F. J. S. Hosken, general manager and engineer. |
| Dundee ... ... | Bailie Buist, chairman.<br>Peter Fisher, general manager and engineer. |
| East Ham ... | Alderman Murrell Oakes, J.P., chairman.<br>W. C. Ullmann, engineer and manager. |
| Erith ... ... | Councillor G. C. Humphreys, chairman.<br>J. C. Williams, engineer and manager. |
| Glasgow ... ... | Bailie M. W. Montgomery, chairman.<br>James N. Wilson, secretary and treasurer. |
| Halifax ... ... | Councillor C. F. Spencer, chairman.<br>Alderman A. Fawcett, vice-chairman.<br>Councillor A. Broadley, member of committee.<br>Councillor A. Seed, member of committee.<br>J. D. Caird, traffic manager.<br>J. W. Galloway, tramways engineer. |
| Huddersfield ... | Councillor E. H. Sellers, chairman.<br>Councillor T. Canby, vice-chairman.<br>R. H. Wilkinson, general manager. |
| Hull ... ... | Councillor W. Hakes, chairman.<br>Councillor C. Raine, J.P., vice-chairman.<br>William J. McCombe, manager. |
| Ilford ... ... | Councillor O. Waters, chairman.<br>Councillor J. Lowe.<br>L. E. Harvey, engineer and manager. |
| Keighley ... ... | Councillor Albert Smith, chairman.<br>Harry Webber, general manager. |
| Kirkcaldy ... | Councillor G. Fergusson, chairman.<br>O. F. Francis, engineer and manager. |
| Lancaster ... ... | Councillor T. Wilkinson, chairman.<br>J. B. Patterson, acting borough electrical and tramway engineer. |
| Leeds ... ... | Alderman R. A. Smithson, chairman.<br>Alderman H. Brown, vice-chairman.<br>J. B. Hamilton, general manager.<br>A. Daggett, traffic superintendent |
| Leicester ... ... | Alderman S. Flint, J.P., chairman.<br>Alderman G. Banton, J.P., vice-chairman.<br>A. F. Lucas, manager and secretary.<br>T. R. Smith, electrical engineer. |
| London County Council ... ... | W. J. Squires, J.P., vice-chairman of the Council.<br>A. H. Scott, J.P., vice-chairman Highways Committee.<br>A. L. C. Fell, general manager. |
| Lowestoft ... ... | Herbert H. Saunders, general manager. |
| Maidstone ... ... | A. T. Lambert, general manager. |
| Manchester ... | Alderman J. Bowes, J.P., chairman.<br>Alderman A.W. Chapman, M.D., vice-chairman.<br>James Wood, deputy general manager. |
| Nelson ... ... | Councillor W. F. Cooke, chairman.<br>G. F. Nayler, manager and engineer. |
| Newcastle-on-Tyne | Councillor Richard Mayne, J.P., chairman.<br>Councillor S. T. Taylor, member of the committee.<br>Ernest Hatton, general manager and engineer. |
| Newport ... ... | N. J. Young, general manager. |
| Northampton ... | Councillor T. D. Lewis, chairman.<br>John F. Cameron, general manager. |
| Oldham ... ... | Councillor J. K. Cheetham, chairman.<br>P. Priestly, general manager and engineer. |
| Plymouth ... ... | Councillor J. Moon, vice-chairman.<br>C. R. Everson, general manager. |
| Portsmouth ... | Councillor J. Timpson, chairman.<br>Alderman R. Payne, vice-chairman.<br>W. R. Spaven, general manager. |
| Preston ... ... | Alderman J. Ormrod, chairman.<br>Councillor T. Parkinson, vice-chairman.<br>J. F. Simpson, engineer and manager. |
| Rawtenstall ... | C. L. E. Stewart, general manager and engineer. |
| Reading ... ... | Alderman C. G. Field, J.P., chairman.<br>G. F. Craven, general manager and engineer. |
| Rochdale ... ... | Alderman James Taylor, chairman.<br>George Webster, manager and engineer. |
| Rotherham ... | Councillor T. Reeves, vice-chairman. |
| Salford ... ... | Alderman H. Linsley, J.P., chairman.<br>G. W. Holford, general manager. |
| Sheffield ... ... | Alderman W. C. Fenton, vice-chairman.<br>Alderman J. Knowles, chairman of engineering sub-committee.<br>A. R. Fearnley, general manager. |
| Southampton ... | Alderman F. A. Dunsford, J.P., chairman.<br>W. T. Robson, general manager. |
| Southport ... | Alderman T. P. Griffiths, J.P., chairman.<br>Councillor Clayton, vice-chairman.<br>Thos. J. Kendrew, general manager. |
| South Shields ... | Alderman W. G. Wylie, chairman.<br>Councillor J. G. Winskell, vice-chairman.<br>J. C. Whiteley, general manager. |
| Stalybridge ... | Alderman R. Wood, chairman.<br>Frank Schofield, commercial manager. |
| Stockport ... ... | Alderman Charles Staples, chairman. |
| Wallasey ... ... | Councillor F. E. Howse, chairman.<br>R. R. Greene, general manager. |
| Walsall ... ... | R. L. Horsfield, general manager. |
| Walthamstow ... | W. R. Clarke, chairman.<br>R. J. Bishop, vice-chairman.<br>W. Murray, manager. |
| Warrington ... | J. Telfer, general manager. |
| West Ham ... | Alderman R. Mansfield, J.P., mayor.<br>Councillor George Kensett, chairman.<br>L. Slattery, general manager. |
| Wigan ... ... | Alderman R. T. Fletcher, chairman.<br>Councillor Jas. Walkden, vice-chairman.<br>Alderman E. Dickinson.<br>F. Buckley, general manager. |
| Wolverhampton ... | C. Owen Silvers, general manager and engineer. |
| York ... ... | J. W. Hame, general manager. |

There were also present the following :—

Mr. H. E. Blain, operating manager, Underground Railways and London General Omnibus Company.

Mr. W. G. T. Goodman, chief engineer and general manager, Municipal Tramways Trust, Adelaide, and President of the Tramways Association of Australia.

*Representatives of the Tramways and Light Railways Association.*

Mr. H. W. Laing, general manager, Blackpool, St. Annes and Lytham Tramways Company, Limited.

Mr. J. Cameron, general manager, Blackpool and Fleetwood Tramroad Company.

Mr. H. England, general manager, Yorkshire (West Riding) Electric Tramways Company, Wakefield.

Mr. E. H. Edwardes, general manager and engineer, South Lancashire Tramways Company.

Mr. A. E. Paris, managing director, Yorkshire Woollen District Electric Tramways Company.

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## THE OPENING PROCEEDINGS.

The 16th annual general meeting and conference of the Municipal Tramways Association (Incorporated) took place in Blackpool on Thursday and Friday, September 20 and 21 last.

Mr. Henry Mozley (general manager, Burnley Corporation Tramways) the president of the Association, occupied the chair, and asked the Mayor of Blackpool to say a few words to the delegates.

The MAYOR OF BLACKPOOL (Mr. A. L. Parkinson) said.—It is a great pleasure to give you a welcome in the name of the inhabitants of Blackpool on the occasion of your 16th annual conference. In 1907 we had the Conference of the Municipal Tramway Managers in Blackpool; in 1911 we had a visit of the Lancashire and Cheshire Tramways Association, in 1913 a visit of the Tramways and Light Railways Association, and now in 1917 we have the Municipal Tramways Association here. We have therefore had a fair number of conferences representing different systems of tramway undertakings. I know that the tramway managers and the chairmen of tramway undertakings always believe in business first and pleasure after. You have met at a time when you will have to take into consideration whether the Association will not have to ask Parliament to give them some little grant or a recognition of a revision in fares. I believe that there are 16 tramway undertakings which are not able to turn the corner in regard to any surplus. That means that, if they have to carry on, with the increased wages, cost of material, etc., they are going to be in a very depleted state. There are 20 systems whose surplus profits do not exceed 6d. per 100 passengers, or ·06d. per passenger. If these undertakings belonged to public companies they would be working at a loss if they had to replace any of their worn out material at increased prices. We know that after the war the original prices will not come back. Your deliberations I hope and trust will proceed in the spirit which has characterised your previous conferences, and I hope that much good may result. It is by the brains of the country meeting together, reading papers and criticising that we get so much help for the undertakings throughout the country. We in Blackpool, of course, do not need to say much about our tramway undertaking, because, as most of you know, we have a big surplus profit every year. That largely arises because of the number of visitors who come here to enjoy the fresh air and the bracing breezes. I believe also from our experience that the more tramway undertakings you can get in outlying districts the better it is for the town. In our case the tramway system was laid out so as to go round the outlying districts, and the profit that has been made by building has repaid the town many times over. (Hear, hear.) I hope much good may come from your meeting, and on behalf of the Corporation I have to invite you to lunch to-morrow with the Tramways Committee. (Applause.)

The PRESIDENT.—I am sure I shall be expressing the feelings of the conference if I say that we give a hearty vote of thanks for the kind words of welcome from the Mayor of Blackpool, and also for the very useful and appropriate remarks which he has made in regard to the tramway position. (Applause.)

The MAYOR OF BLACKPOOL.—I thank you for your vote and hope we shall see you all at lunch to-morrow.

The PRESIDENT.—We are very fortunate in coming to Blackpool, and in view of the numbers present I think the decision of the Executive Council to hold a meeting here is fully justified. I have to express the welcome of the conference to gentlemen from different undertakings, and especially to those I am now going to name:—Mr. Goodman, general manager and engineer of the Adelaide Municipal Tramways Trust, who is also president to the Tramways Association of Australia (applause); and our old friend Mr. Blain, of the London General Omnibus Company, and also members of the Tramways and Light Railways Association and of the Incorporated Municipal Electrical Association. We give these gentlemen a hearty welcome and shall be very pleased if they will join in the discussion and assist us in any way they can. I have a letter of apology from Mr. McElroy. He has been, as you know, a member of the Association since 1902 and this is the first occasion on which he has been unable to be present. He is now recuperating in Devonshire, and I do not blame him for staying away from our conference, as I think he is doing more good to himself, but still I feel his absence, and I have no doubt that is the experience of all of you. We hope his visit to Devonshire will do him good. Mr. Spencer, of Bradford, unfortunately cannot be here. He is on Government work and we know, owing to the state of the country, that he is better engaged perhaps than if he were here. I ought to mention Mr. Dalrymple, because he has been put down to discuss a subject, and he is also one of our most useful members. As you all know, the King is in the North and it would not be right for the Tramways Manager of Glasgow to be absent on that occasion. I will now proceed to read my address, and I hope you will be patient with the views I may express. I will accept any challenges after the conference on any subject with which I may deal. I have, as you know, certain weaknesses which I cannot always overcome.

## PRESIDENTIAL ADDRESS.

BY HENRY MOZLEY
(*General Manager, Burnley Corporation Tramways*).

One of the duties connected with the office of president which I have the high honour to fulfil is to address the members at the Annual Conference upon subjects which appertain to the special department of municipal activity represented by Tramway Committees and their managers, and I do so upon this occasion with a certain amount of diffidence because my long connection with the industry necessarily brings with it certain pronounced opinions developed by experience which are not always welcomed by the men who are growing up in the industry, but who nevertheless, I am sure, appreciate any effort to help on the good work of developing and perfecting the working and management of tramways.

First let me say a word in favour of this Association, which has performed great and useful duties in the past, but which, I am convinced, has a much more important future in store, believing, as I do, that the development of the tramway and now also the omnibus industry has not by any means reached its highest expansion in this country. On the contrary, it must be within the knowledge of all our members that in each of our areas there are local branch lines or connecting lines with other districts which are waiting only for an enterprising municipality to bring about their construction and consequent benefits to the community. The practically total suspension of new construction brought about by the war we may hope will cease within a reasonable time, and until this happy moment arrives this Association can and must prepare for the great and inevitable changes which will occur in the new world to which we are all looking forward.

Ever since my introduction to municipal life I have felt what an absurdity it is to repay the whole capital, within very limited periods, of an industry like that of the tramways, which is ever growing in value, at least those undertakings which have been wisely laid out and properly developed. Why should the first generation of inhabitants make a present to the second generation of property bringing in thousands a year, when this can only be done by burdening themselves with heavy charges annually instead of taking a legitimate toll or dividend for the monies expended? I suggest the policy of municipal authorities providing sinking funds for everything alike, whether for a pure business undertaking such as a tramway or works necessary for the conveniences of life, such as streets, sewerage, parks, etc., is wrong, and although it may be law it is the business of this Association to get the law altered, and I suggest this subject as one deserving of early attention.

Certain undertakings have felt the inconvenience of the sinking fund during the war especially, but there does not appear to be any prospect of temporarily obtaining powers to suspend the charge, with the consequence that the rates have become hable, and this naturally leads to the consideration of fares and their effect on the financial position. This is a subject which this Association can very usefully consider. Unlike the railway companies, municipal authorities after securing certain statutory fares began to give very much cheaper fares both for workpeople and ordinary passengers, and at present in some cases this policy is being continued with disastrous consequences to the financial stability of the undertaking. This Association can and should exert its influence to help such undertakings to remedy such errors, and secure more uniformity in charges. It is the common experience of all to have flung at them such remarks as "Such and such a tramway gives three miles for a penny, why can't you?" Probably it would be useless to tell the person that the cost of carrying a passenger three miles is considerably in excess of one penny, and that the loss is made up from the shorter journey passenger. It would be better before taking any steps to secure legislation for the undertakings concerned to put into operation the power they already possess of increasing fares, and by open discussion at our meetings healthier and more reasonable views may be created, and thus help to conserve the reasonable fares in operation and to increase such as are unreasonable.

In recent years the tramway industry has benefited by standardisation of material used in common, and in the immediate future we may hope for further help in this direction, but there is a local standardisation desirable, that is to say, for convenient and economical working all cars should be alike in design and dimension on separate undertakings, and in the case of those with connections with neighbouring tramways and light railways not only would more economical working be secured, but interchange of rolling stock facilitated, and neighbouring tramways might thus assist each other in ordinary development and emergencies. How common it is to find cars of design and dimensions differing materially on the same undertaking as well as on neighbouring systems! If the Association could do anything to ascertain the best type and most economical car to use, it would confer a great benefit on the industry in the way of cheaper working and convenience in operation. As time goes on and inter-communication is developed this question will become very important.

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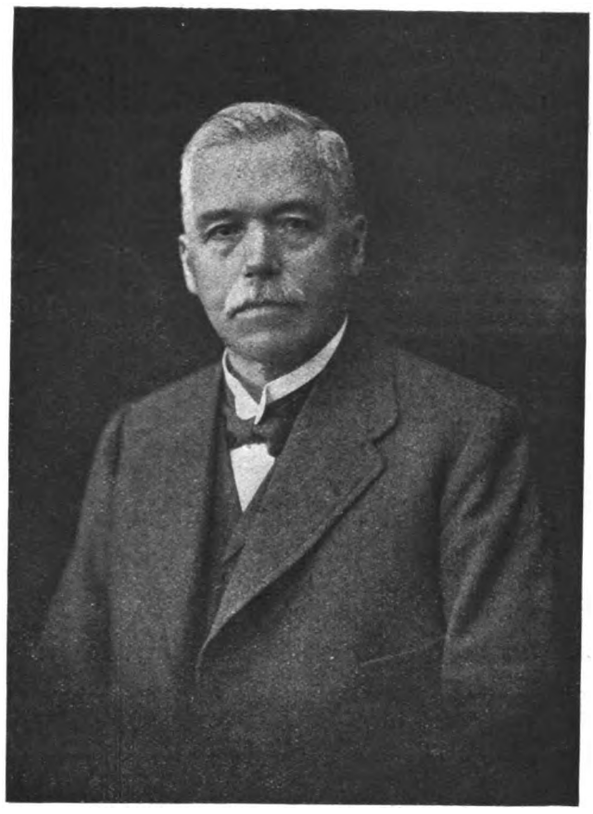
From time to time we hear of difficulties and inconveniences arising owing to the long period which has elapsed since the Tramway Act of 1870 became law, and I suggest that it should be made the business of this Association in combination with the association representing company undertakings, to take up the revision of the conditions brought about by that Act, and secure more liberty in carrying on the tramway business. There should be one tramway authority in combined areas to control all traffic problems and developments with representative boards. Every one must be conscious of the incomplete effect of a number of small undertakings operating in what is practically the same district, whereas, if combined, the result would not only be more economical working but a greatly increased convenience to the public. In these days of manufacturing syndicates, what an advantage it would be if combined tramway undertakings could buy their material in bulk, also why should there be any restriction as regards manufacturing for one's own requirements—either cars, working parts, or other material in daily use? The power to do this should be secured by law. But I need not further enlarge here on the amendments in the Act of 1870 which are desirable, but throw out the suggestion that the Association should give immediate attention to the subject.

In common with the rest of the business community, it behoves us to prepare for the great changes which are bound to come after the war. Amongst other subjects the questions suggested by the Whitley Report issued by the Reconstruction Committee should receive the immediate attention of the Association. Here at least we are in a position to carry out without delay one of the principal recommendations, viz.:—

> "That the establishment for each industry of an organisation representative of employers and workpeople, to have as its object the regular consideration of matters affecting the progress and well-being of the trade from the point of view of all those engaged in it."

Our organisation being national, and areas being provided in most cases with local associations, we have only one step forward to take, that is to invite representatives of the workpeople to share our conferences and responsibilities.

There must be some better way of arriving at agreements for working conditions, wages, etc., than the present inequitable and slow one. Agreements amongst ourselves are better than the impositions of an outside and unsympathetic authority, which can only consider tramways in the lump, and which is bound to disregard the local conditions of individual tramways.



**Mr. Henry Mozley,**
*President, Municipal Tramways Association.*

Having pointed out what I consider to be work of importance for the future, the past history of the Association deserves a word of commendation. I claim that although the Association is comparatively young a very large and important work has been accomplished in the past, and this is not merely traceable in our records, but everyone who has attended the conferences must be aware of the useful knowledge obtained by mere contact with men engaged in similar work by the exchange of notes and the willingness to help one another in all manner of ways which cannot be detailed in journals.

I have been attending conferences for more years than I care to remember, and have always been able to pick up some information in one form or another which has helped to render my work easier and better, and I have no doubt that that is the experience of all; therefore I hope that notwithstanding the times in which we have our present being, we shall continue the good work of meeting annually, and if it were better understood the managers' section would resume their annual conferences, which have now been suspended for three years. There must be large arrears of technical matters to consider which are unsuitable for public discussion; for instance, the costly brake inquiry and report has not yet been discussed.

One word more. During the past year, as the report of the Executive Council will show, a vast amount of business has been transacted of the highest importance to the industry, and I have to thank those members of the Council and the hon. secretaries for their helpful support during my year of office. Owing to the exigencies of Government we have lost the help of at least four important members of the Executive Council, viz., Messrs. Hamilton, McElroy, Spencer, and Clough, who were called upon early in the year to assist the Admiralty in an important department of its activities. It is no small honour to this Association that it should be privileged to help the Government, and it confirms the choice we have made in the past of eminent men to serve on our Executive Council.

In conclusion, I might say it will always be a source of pride to me that I was privileged to occupy this chair, the highest honour which the Association can bestow.

### VOTE OF THANKS TO THE PRESIDENT.

Alderman S. Flint, J.P. (chairman, Leicester Tramways Committee).—I have pleasure in moving a hearty vote of thanks to our president for the interesting paper he has read to us. It has proved practical and business like, and very appropriate to the conference. Many of the questions he touched upon we should like to discuss, but that is forbidden, as the president's addresses are never discussed in our conferences. I notice, however, that several points which he has mentioned are coming up later on for debate. The address is just such a one as we should have expected from the president—no words wasted and just touching lightly and briefly on various points, but each point of practical interest at the present time. We all owe him a very considerable debt for his paper, and I move that our hearty thanks be expressed.

Alderman W. G. Wylie (chairman, South Shields Tramways Committee).—It is my pleasure to second the motion for a vote of thanks to our president. We have heard his address with great pleasure, and if there is one man in the Association who can address the company as a tramway man it is our chairman, owing to his long experience of tramway matters. The items touched upon are most important and interesting. Some of them appeal to me very strongly, as they do to you. (Applause.)

Mr. J. B. Hamilton (general manager, Leeds City Tramways).—May I say a word in support of the motion? I should like to thank the president on behalf of my colleagues in the Admiralty for the very kind references he has made to our work. I can assure you from those who are unable to be present that it is with the deepest regret they find themselves so situated that they cannot be here. Both Mr. McElroy and Mr. Spencer were original members of the Association, and they look forward to the meeting of the conferences as bright days of the tramway year. I note now the presence for the first time at our conference of ladies. I take it is an augury of that wider and, perhaps, more useful sphere which ladies in the future are to occupy in the work of the world. I have no doubt, if we are spared long enough, we shall see a mixed conference of lady managers and gentlemen managers. (Laughter.) Those of us who are married know how much the ladies have assisted us in carrying out our work. In fact, we are the mere figureheads to be moved as required. I rose principally for the purpose of drawing attention to the fact that ladies were present, so that gentlemen might moderate their language accordingly. (Laughter.)

The motion was unanimously agreed to.

The President.—I thank you very much. We will now proceed with the first discussion. The first paper is "Notes on Tramway Finance," by Messrs. Barnard, Holford, and Priestley. You will see that in future, papers are only to be submitted and a synopsis given by the authors, unless the writers desire to read the papers in full. I think the most convenient course will be for one of the three authors of this paper to give us a synopsis, as we have a great deal of business to get through.

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# NOTES ON TRAMWAY FINANCE.

MESSRS. J. BARNARD (*Bolton*), G. W. HOLFORD (*Salford*), and P. PRIESTLY (*Oldham*).

When the suggestion was first made by our worthy President that the title of our remarks might be "What are the principles which should ensure the highest net earning capacity of a municipal tramway undertaking?" we decided that this was somewhat too serious a question to reply to without considerable time for deliberation and thought. As you are all aware, under the abnormal conditions through which we are passing leisure hours are almost an unknown quantity not only for tramway managers but for all those engaged in tramway work. We have not therefore ventured to answer the query in a direct manner, but called attention to what may be termed the main features of the "income" and "expenditure" sides of our various undertakings, hardly in the nature of a "paper" in the usual understood sense of the term, but merely as points of interest which may result in an interesting discussion.

We will first refer to the "income" side of our accounts, and suggest that the following are usually the principal sources of revenue upon which depend to a very large extent our financial success or otherwise, namely:—

1. Tramway fares. 3. Advertising.
2. Parcels. 4. Investments, etc.

It will be found desirable to deal with the above items *seriatim*, namely:—

### 1.—TRAMWAY FARES.

These may be sub-divided into

(*a*) Fares for ordinary passengers.
(*b*) Fares for workmen, etc.
(*c*) Children's fares.

#### (*a*) *Ordinary Passenger Fares.*

In dealing with the fares charged to ordinary passengers we have to consider that the usual rate stipulated in the Acts of Parliament is fixed at 1d. per mile (there are exceptions, no doubt, which will be mentioned by members present), and we are aware, particularly in some of the smaller undertakings, these rates are already in operation. How, then, can their revenue be increased? Some may suggest that if the fares were cheapened there would be more riders. This may result to a limited extent, but it is not always an easy matter to cheapen a 1d. fare successfully, as usually there are only two alternative methods of carrying this out. First, to reduce the penny stage to a halfpenny one (which is an arrangement we are most strongly opposed to), or, secondly, to extend the stage. In either case a considerable increase has to take place in the number of passengers carried before the previous revenue is obtainable, and it is more a matter of local knowledge of the several undertakings as to the probability or otherwise of a sufficient increase of passengers taking place as would ensure a larger revenue. What other method is then open to these undertakings under the present restrictions contained in the Acts of Parliament? There does not appear to be one, but if Parliament can be induced to raise the rate per mile chargeable by tramway operators then there is a possibility of larger revenue being obtained. This matter is at the present time receiving attention at the hands of the Executive Councils of both this Association and the Tramways and Light Railways Association. Many tramway undertakings, who were charging less than the statutory limits, have increased their fares in view of the additional expenditure prevailing, necessitated by the abnormal conditions. In most cases the authors understand the results have been of a satisfactory character. Each undertaking will no doubt carefully consider local circumstances before taking a similar course; but as almost every commodity has increased in cost there does not appear to be any reasonable objection to tramway operators endeavouring to meet their increased expenditure by adopting this principle.

#### (*b*) *Workmen's Fares, etc.*

The general basis of charge allowed by Act of Parliament for workmen's fares stipulates that during certain hours of the morning and evening workmen shall be carried at fares not exceeding ½d. per mile, but usually the operator is not called upon to charge a less fare than 1d. Many undertakings to-day are charging workmen's fares at the highest possible rates allowed. In their case it would seem almost hopeless to increase the revenue from that source unless the amount allowed to be charged under statute is increased. Some undertakings have endeavoured to obtain custom by offering a cheaper rate of fare if the passenger will purchase a "return ticket," but in our opinion very little benefit is being obtained in this direction for the revenue of the undertaking, and, in fact, in many cases the action results merely in giving to the rider a concession which is very rarely justified, as in most cases the passenger would use the car even if he had to pay the single fare for each journey. It is, moreover, an arrangement which offers much scope for abuse, and generally does not work in a satisfactory manner. In these cases we suggest that a review of the concessions allowed would undoubtedly be of benefit to the undertakings interested.

Other undertakings are allowing workmen and early morning riders to travel at cheaper rates than those stipulated in the Acts of Parliament. If the balance sheets of these undertakings are showing reasonable profits, then perhaps the action of the committees in charge may be justified, but if not, then we submit that they should revise their charges so as to agree with those provided by Act of Parliament. Even where a profit is being shown in the general working of the undertaking, it may be found on close investigation that the "early morning" passengers are actually being carried at a loss, and the passengers paying the usual rate of fare are contributing to make up this loss. Again, in other towns no distinction is made between the fares charged to workmen and early morning riders and those charged throughout the day. Of course, in these cases it must follow that the fares charged throughout the day are not higher than those provided by law for workmen's fares; and again, if the financial results at the end of the year are satisfactory, this system will no doubt be continued.

#### (*c*) *Children's Fares.*

The system varies in numerous undertakings with regard to the age limit for children's fares. In some instances these fares are on too liberal a scale, and would well repay revision. We submit that a general principle would be to allow children under three not occupying a seat to travel free; if occupying a seat, half-fare; and half-fare to all children between the ages of three and twelve years.

Many concessions of varying character have been granted in tramway undertakings in the past in the shape of contract tickets, pre-paid tickets, etc. In some cases the privileges have been granted in response to appeals from various sections of the community, and in others have arisen from a rather too generous spirit on the part of the Tramways Committees concerned. The authors are of opinion that it is not in the interests of a municipal tramway undertaking to encourage the granting of privileges or concessions to any section or class of the travelling public, and in many instances revenue would be increased if these concessions were withdrawn and the proper scale of fares enforced.

### 2.—PARCELS.

A number of undertakings are obtaining revenue from the carriage of parcels. In some cases the work is of an extensive character, and in others very limited.

It is difficult to suggest a method by which the revenue under this heading can be increased, as the prices chargeable are usually fixed under bye-laws or other regulations, but in undertakings where the carriage of parcels has not been attempted there may be additional revenue obtainable provided the working expenses are kept as low as possible and the local conditions are favourable. The revenue derivable from this source is largely influenced by the fact or otherwise of an undertaking being in close proximity to one or more undertakings already having a parcels carrying system. As some parcels systems are practically "semi-subsidised," i.e., by having the use of cars, omnibuses, etc., a proportion of the cost of which is not usually debited to the parcels account, it is questionable whether these parcels systems are actually profitable, even when they show a credit balance. The fact should, however, not be lost sight of that although revenue may be derived the undertaking may be suffering indirectly by the motormen or conductors having their minds diverted from the proper carrying out of their duties of driving the car or collecting fares, by reason of the frequent stopping of the car to collect or deliver parcels.

In some cases additional revenue has been gained by charging passengers for all excess luggage. This system does not involve any extra expenditure, and can be carried out by the conductors in their ordinary course of duty.

### 3.—ADVERTISING.

This source of revenue is not common to every undertaking. Considerable difference of opinion exists in many towns as to the wisdom or otherwise of utilising tramcar vehicles for advertising purposes. Certainly the vehicle is deteriorated to a material extent when metal advertisement signs are fixed to it, and its appearance is not improved even by advertisements which are painted on the side-boards, etc.

To those who advertise the period we are passing through offers very little prospect of higher revenue being obtainable. To those who do not allow advertising there may be opportunities of increasing revenue, but certainly the present is not the time when the best results can be expected.

We have no doubt there will be present advocates both for and against advertising.

From the experience of the authors it has been found that the value of a tramcar as an advertising medium has been on the down grade for several years, as shown by the reduced offers for advertising rights, and on general principles is not one to be commended.

### 4.—INCOME FROM INVESTMENTS.

This is an item which is hardly controllable by the management of an undertaking.

Much depends upon the system in operation in the various cities and towns. In some cases the interest accruing from invested funds is credited to the general fund account of the Corporation, in others

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to the revenue account of the tramway undertaking, and again in other cases to a particular fund, e.g., depreciation, renewals, etc., so that opportunity for obtaining a measure of increased revenue from this source appears very limited. We are firmly of opinion that the tramway fund should be credited with all the interest accruing from its investments, and consider it is a matter which would repay a careful investigation.

Having touched upon the principal items of "income," we will now turn to the main items of "expenditure," and these are included generally under the following headings, namely :—

1. Power. 3. General.
2. Traffic. 4. Accident insurances, etc.
5. Repairs and maintenance.

1.—Power Expenses.

This item in our accounts is of a very important character, not only with regard to the consumption of current per car-mile run but also as to the price paid for the supply of electrical energy, or the cost of production in undertakings where the generation of the energy is in the hands of the tramways department. With respect to the consumption per car-mile it should be an endeavour (and we believe it is in every undertaking) to keep this as low as possible. We find, however, that it is of a very varying character. Frequently, under apparently exactly similar conditions, the consumption may become higher or lower. How is this accounted for? No doubt most of us have had interesting discussions from time to time with the powers that be with not always satisfactory results. We know that when we compare the consumption per car-mile between different undertakings many factors have to be taken into consideration, such as the system of feeding, the type and weight of cars used, the number and degree of gradients, the type of electrical equipment, the length of service of the motormen, and many others.

In many undertakings the arrangements with regard to the price charged by the electricity department to the tramways department appears to be of a somewhat unfair character, the tramways department having to bear the cost of cables and all losses of transmission from the generating station to the section boxes, as compared with the method of charging manufacturers, who are not usually called upon to bear the cost of cables, and further, are charged for the current consumed as registered in their works, which relieves them of transmission losses, and frequently the actual price to be paid is lower than that charged to the tramways undertaking.

In other instances, where the feeder cables are the property of the electricity department, considerable economy could be obtained if the feeding arrangements were improved, but as this means an additional expenditure for the extra cables, the department supplying the energy is generally loth to increase their capital expenditure with the probable result of reducing their income. Some arrangement might be arrived at between the two departments whereby this expenditure could be shared, and the ultimate result would be beneficial to both departments.

With the present high price of coal it is hardly the best time for tramways departments to approach the producers of their electrical energy for reduced charges, but it is submitted that as soon as the price of coal begins to cheapen the price of electrical energy should be reduced in many undertakings, and we are satified that in fixing such price a sliding scale with regard to the price of coal should be provided for.

When we consider the effect of the type and weight of cars used, it is only reasonable to expect that if we add top deck covers to our cars, or purchase cars of a heavier type than those previously in use, the consumption per car-mile will increase. We are also aware that in towns where the gradients are of a serious character the energy used must be greater per car-mile run, etc.

As regards the human element, it is a fact that the experienced and careful motorman can and does save in the use of electrical energy. A new driver naturally takes considerable time to accustom himself to the stopping stations, to the amount of energy required on various sections, to the coasting up to compulsory stations, etc., all of which, though small matters in themselves, when multiplied by an extensive car-mileage, may mean serious additional expenditure. Careful watching on the part of experienced inspectors will often be found very beneficial in reducing this waste to a minimum. Systematic examination of the electrical equipment of the cars is an absolute necessity. Unfortunately, with the dearth of labour now experienced, it has not been possible on all undertakings to carry this work out in the desired manner, but it is of so important a character that no time ought to be lost immediately things become more normal in thoroughly overhauling all electrical and mechanical working parts of the car equipments to see that no unnecessary consumption of electrical energy is possible due to defective or worn equipments.

To those who have not already adopted car meters we strongly recommend their use, having practical experience of their great value in checking the excessive use of current on the cars. It should be noted that the best results can only be obtained if the records of each car and each man are carefully registered and studied from time to time. Indifference in this respect entirely nullifies the value of the use of the car meters.

Having dealt at some length with this item of exenditure, we will now refer to the next one on the list, which is also of a most important character, viz. :—

2.—Traffic Expenses.

Under this heading are grouped many items of expenditure which are familiar to most of us, namely :—Wages of traffic employees, cleaning and oiling of cars, the salting and sanding of track, fuel and lighting of depots, ticket check, uniforms, etc. These items usually represent the largest proportion of the expenditure of a tramway undertaking, and occupy the careful attention of every tramway manager. The rates of wages to be paid to the several branches referred to are not, and very properly so, matters to be left to the decision of the management, but are usually decided by the committee in charge, and are arrived at for different reasons and by varied methods. It is hoped that in the near future some system of standardisation of wages will be brought into operation which will control the rates to be paid in various areas, and so remove the numerous differences that exist in wages paid to men carrying out similar work under practically similar conditions, and if differences arise then we ought to be in a position to take such differences before a properly constituted authority appointed for the various localities, which should have power to settle the matters in dispute. At the present time practically all undertakings are burdened with large payments in respect of war bonus, but it is earnestly hoped that some relief may be experienced with regard to this expense as soon as the war ceases. The only economy that suggests itself in dealing with wages is that each undertaking carefully observes that no more labour is employed than is absolutely necessary, lists of spare men, stand-by men, etc., being kept at the lowest limits. With respect to material for cleaning and oiling cars, and salting and sanding track, it is admitted that at the present time we are called upon to pay abnormal prices, and the only way to meet this expenditure is by reducing the quantities used to as low a figure as possible. The adoption of inferior qualities is not in our opinion a true economy. Similar remarks apply equally with regard to the materials required for salting and sanding of track, for fuel, etc., for depots, tickets and uniforms. No doubt early after the termination of the war prices will begin to fall, but probably will not again reach the level of pre-war rates.

3. General Expenses.

This heading includes many items which are not controllable by the management, such as rates and taxes, insurance charges, etc., and due economy in other directions, such as printing, etc., is no doubt practised in all undertakings.

4. Accident Insurances, etc.

The method of dealing with claims arising out of accidents differs in various undertakings. Some undertakings carry their own risks, whilst others prefer to pay premiums to insurance companies to relieve them of their liabilities. We are of opinion that in the main it will be found more economical and certainly more satisfactory for the undertakings to carry their own risks. Certain undertakings pay bonus to employees for freedom from accidents, and probably members who have adopted this course will testify as to its beneficial result or otherwise.

5. Repairs and Maintenance.

This is an important item in our expenditure account, including, as it usually does, repair and maintenance of permanent way, rolling stock, overhead equipment, and sundry other plant and vehicles. In dealing with the labour side of this subject we have (as in the case of traffic expenses) to meet abnormal expenses for war bonus to the different trades engaged. It is not probable that any reduction will take place during the war, but possibly even further increases may be allowed, so that again it is desirable to reduce the work as far as possible, having due regard to the necessities of each case. Materials are, of course, excessively dear to purchase, and we can only again meet this difficult problem by practising the utmost economy in the quantities to be used. A considerable amount of work on the permanent way is held up at present, but must be carried out in the near future, and due provision should be made to meet this expense.

Having reviewed at considerable length both the income and expenditure account of tramway undertakings, our general conclusions may be summarised under the following headings :—

1. That increased revenue may be obtained—
   (*a*) By an alteration—if Parliament or the Board of Trade will permit—in the maximum charges fixed by statute for the carriage of passengers; this applies where the undertakings are already charging statutory rates.
   (*b*) That in other undertakings further revenue may be obtained by increasing the fares charged, and abolishing all forms of concessions and privileges.
2. That expenditure can only be reduced—
   (*a*) By the employment of the minimum number of employees required, and by the utmost economy in the quantities purchased of the materials necessary for the reasonable maintenance of the various branches of tramway undertakings.



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(*b*) By a careful review by each undertaking of the several items referred to in our previous remarks which may offer opportunities for reducing expenses in particular instances, and that municipal tramway undertakings should at all times be regarded as commercial enterprises, and be dealt with strictly on these lines, and that provision should invariably be made for depreciation and renewals on sound financial basis before contributions are demanded from the undertaking towards relief of rates or for any other purpose.

**THE DISCUSSION.**

Mr. G. W. HOLFORD (general manager, Salford Corporation Tramways) read a brief summary of the paper, which is given in full above.

Alderman C. F. SPENCER (chairman, Halifax Corporation Tramways).—It is with pleasure that I rise to open a discussion on matters of finance which must be of absorbing interest and engaging attention to every one in this audience. This paper has a very expressive and expansive title, and in these days when national finance is of a very complex character, and sometimes of a critical character, tramway finance must, to a limited extent, be irretrievably and indissolubly bound up with it. When I read this paper once I decided to read it twice, and when I had read it twice, I decided to read it a third time. After the third time I came to the conclusion that it was more notorious for what it did not say than for what it did say. Sometimes our papers are all of a more or less academic interest, but this paper is of a provocative character, which will enable us to have a discussion of a lively character. The observations I have to make deal, perhaps, on a broader plane than those which characterise the paper. I would put them in eight headings for discussion :—(1) The question of national finance and how it affects municipal finance; (2) the rising wages costs; (3) the increase in material costs; (4) the increase in income from fares; (5) the reduction of electrical power costs; (6) the expense of Parliamentary procedure; (7) weakness and strength of municipal administration; (8) new adoptive policies.

Finance to-day is of an exceedingly complex character. In pre-war days local authorities were borrowing money in the neighbourhood of 3½ per cent. To-day it is something over 5 per cent. With that short term loan system which has been so successful for many decades in this part of the world, we have found tramway finance is hampered and likely to be hampered for many years by the increasing rates of interest. When we consider the growth of our national debt we do not know what it is going to be, but we can see at the moment something between £5,000,000,000 and £7,000,000,000. That is going to absorb a great deal of interest, which can only be paid through national taxation sources. In addition, the sinking fund has to be provided, and all this means high rates, which will react on the municipal boroughs. Against that, there has undoubtedly been a great speeding up of industry. We have learnt that there is such a thing as standardisation, whereby we can get greater output in our factories which will help to pay some of the interest on the national debt. I should like to read to you a few observations on finance which I gave before a tribunal on finance.

"There are two factors which have made money rates increase, namely, (*a*) the demand of the Government for loans, and (*b*) the rise in income tax rates. The Government demands for loans no one can tell the extent of, consequently this uncertainty must, unless rates of interest are controlled, or securities are mobilised, increase rates of interest. Every £100,000,000 which the Government raises means less available supply after the war, and we get to the position that the last £500,000,000 may have to be raised in an entirely different form to that which we have been accustomed to, perhaps on the basis of a loan having a relation to the income tax assessment. It is obvious that the more we raise during the war the less we have for after the war, and that as a consequence, on account of the law of supply and demand, the rates of interest must be attractive, and that means higher prices. I regard the increase in income tax as having a very great influence on the investor in maintaining his demands for higher yielding investments. I am of opinion that demands for Government loan purposes must involve increased rates of interest unless, (1) interest rates are controlled, (2) home securities are mobilised, (3) a voluntary loan on income tax basis, with a penal income tax is made, (4) a forced loan is created.

"In any case, after the war demands for money would appear likely to be heavy as :—

"(1) Local authorities' works, even necessitous works such as sewage and water schemes, have been suspended for the period of the war.

"(2) Industries which are necessary for competing with German trades have not been fostered to the extent which circumstances demand.

"(3) If the war continues for two years it may be necessary to mobilise the nation for military and munition purposes, to the exclusion of purely non-war purpose productions.

"(4) The demand for shipbuilding and railway work will probably be great.

"(5) The sale of foreign securities will denude us of the interest thereon, and if we want foreign trade we must be prepared to lend.

"(6) The restoration will be needed of towns and cities and industries in allied countries we may be financing.

"The foregoing will only be a small number out of the total demands and will have an effect on interest rates. The sale of securities abroad will mean that we may have to ship more gold to create a balance than in normal times, or increase the bank rate to attract gold, and such increase will have an effect on rates for supply of money. Thus the outlook is one which at the moment can only be measured in the terms of upward rates. Judged broadly we shall probably have, after the war, (1) a huge debt with heavy interest charges to meet, (2) a huge income tax and other heavy taxation, (3) a reduced income from foreign investments, (4) heavy demands for money for municipal, national, and industrial purposes, (5) loans required to maintain foreign trade. The cumulative effect would seem to be higher rates of interest than those which prevail to-day and probably amounting to 7 per cent."

These ideas, I believe, will enable us to judge how far the handicap in the supply of money to municipalities is likely to be maintained. I believe we shall not be long before we find among the municipalities great difficulties in borrowing money at 6 per cent., and I believe the time is coming when municipalities must go to Parliament or go to the Chancellor of the Exchequer unitedly and say, "If we have to borrow in the open market against the Government, you cannot prevent us giving higher rates, and that is going to react on the National Exchequer, and it would be far better if the Government borrowed for the lot—(hear, hear)—and so reduce the charges on municipalities." As to sinking fund suspension, which was referred to by the president, I should be sorry to see any suspension of sinking funds. (Hear, hear.) When some years ago there was a proposal to suspend sinking funds, within ten days I got 500 letters from people who lent money to municipalities and big companies to ask what did it mean, and whether it meant that the local authorities were going to repudiate. The idea of suspension of sinking funds popularly is repudiation. We cannot repudiate, and we must not suspend, but what we have to say to Parliament is, "You must remove the restrictions on tramways, put up our fares, and enable us to pay the sinking fund." As to relieving of rates, I do not believe local authorities ought to put on to commercial undertakings the incubus of heavy burdens to relieve rates. The only thing local authorities have done is to lend their credit. The measure of their credit should be the difference between what a company has to pay and what a local authority has to pay for its money with the collateral security of the rates. Local authorities should not have more than 1 per cent. for the relief of rates, and the whole of the balance should be put into the undertaking for upkeep and maintenance. (Hear, hear.) In regard to the rise in wages, I believe wages have got almost to the breaking point, not because the men do not merit the wages, but because we have too much lavishness in our methods of conducting business and too much Parliamentary interference. What we have to tell the Government departments is that if wages are to increase at the rate they are increasing to-day, then municipalities must come to terms and have a proper readjustment of the position. Beaconsfield once said that increased means and increased leisure are the two civilisers of man. That is true to-day. What we have to do is to pay our men a living wage interpreted on a liberal basis. The men are entitled to nothing more. We must have a spirit of co-operation. We must breathe a new atmosphere of industrial co-operation. We must breathe conciliation between masters and men. The men are not to be treated as automatic machines; they must be treated as part of the undertaking. They must be brought together, getting rid of antagonisms and grievances, and work for the common benefit of the district and nation. Just a word on the increased cost of materials. I believe that from a pre-war point of view materials are going to be a heavy price. Steel tires, rails and axles, there is very little doubt about it, will never return to pre-war prices. We cannot return to pre-war prices and conditions, because the increased wages in the production of these commodities are going to make a difference in the total cost. When one considers that the steel trade of this country has been during the war almost doubled, and that we are likely to take our place in the sun as the great steel producers, and the place which Germany occupied before the war, it will be seen that we must have a greater national output. It will, however, be at a greater cost, and we shall never be able to come down to the prices of pre-war days. Coming back to the wages which are included in the cost of material, I hope we shall, in considering what we have to pay, look on these matters from a broad and comprehensive point of view, and that everything we do in bringing the men and masters together will have a vitalising and vivifying effect. In regard to increase of fares, we all know that every person who walks along the road is a tramway manager. (Laughter.) If the car is two minutes late there is something gone wrong with the tramways. We want to sack that manager. If a parcel of eggs gets thrown off the tramcar and it does not retain its solidity we want to sack the chairman of the Tramways Committee. I have been sacked many hundreds of times. Everybody knows how to work the tramways, but nobody knows how to work them properly except the officers and perhaps one or two members of the Tramways Committee who take an intelligent interest in the work of the department. But we cannot always take an intelligent interest, because we are hide-bound by

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Parliamentary conditions and precedents, and, like Lord Milner, I would say, "Abolish the precedents and damn the consequences." I believe this question of increasing fares has to be dealt with. In our Town Council six months ago they declined to increase the fares, and said they would pay the loss out of the rates, but if the loss did come they would be the first to say that they would have a new chairman and manager. Very few of us have been allowed to increase the fares. I say that there should be no restrictions of any kind. If there is to be any veto, let us have a form of local option, and let the riders have the veto. Coming to the question of electrical power, I believe we have to take a broad and comprehensive view, and not a narrow, parochial one. The parochial boundaries of administration in electricity have to be removed in the national interest. What are we doing? We are wasting millions of tons of coal a year. We are burning coal in grates. We are burning it for steam raising. We are wasting all those products in the coal which have been of such vital importance to Germany. There is more value in the coal than in the steam raised. Why should we not erect electrical plants as near as possible to the pits, and where an adequate supply of water is available, and retain by a process of carbonisation the whole of the derivatives? Utilise the waste gas to fire the boilers, and the boilers will produce electricity, which can then be transmitted from the economical centres of production to the towns where the local authorities can distribute it. That is the national interest standpoint, and in these matters the parochial interest has to go to the wall. I believe there is a time coming when the whole of our gasworks practice will be entirely superseded, and then we shall generate gas by low temperature carbonisation, looking at the gas as the residual and the present residuals as the prime commodities. Then we shall be able to supply electric power at ·35d. or ·3d. We have the grandest national asset in coal which the world possesses. In Norway and Sweden they have water-power. We should take everything possible of value out of the coal, and use electricity as the prime mover of the country in production purposes. Do not forget when you contrast England with America that America employs 50 per cent. more machinery per man employed than we do. That means that they can get the output and pay the higher wages. What America can do Great Britain can do. The system of generating your power at your own place is a wasteful system, wasteful of coal and capital, because the capital is not employed long enough per day. But if the capital can be employed 18 hours per day, then we shall give Great Britain the national asset which is to-day being wasted to the tune of 60,000,000 tons of coal per year. With regard to Parliamentary procedure in dealing with local bills, it is of an archaic character; it abounds in technical elaboration and detail. What I suggest is that we shall have a local administration—that we should have a county board governing what should be done for tramways. We want some governing district body that can really appreciate the local needs. The needs of East Ham, West Ham, and Croydon may not be the needs of Sheffield, Halifax, or Leeds. We all have different needs, and it is the local people who can appreciate that best.

We know the barristers have great dialectical skill, but that does not get rid of the difficulties we have to contend with in regard to boundary questions. In regard to these boundary questions and tramways, what we have to do is to spread a spirit of national interest, not what is best for a particular town but what is best for the community. In regard to municipal weakness and strength, I think we want clarity of comprehension in our municipal work, we want singleness of purpose, and we want unanimity in national and co-operative effort. We are inclined to be a little too parochial and to have too much red tape. Let me read a few extracts from a report by Sir Francis Oppenheimer, late Commercial Attaché to His Majesty's Embassy at Berlin, on the question of tramway management. The municipalities admit that purely public enterprise has been found too thoroughly tied to move as rapidly as desirable, that modern circumstances of trade and industry may require that the best managers cannot be secured among municipal officials with only municipal pay, that Town Councils as controlling bodies show a lack of technical understanding, that the expected profits have failed because the rate of charges had to be lowered in deference to the demands of the people's representatives or because wages had to be unduly increased. The profits under public management were further curtailed by unavoidable concessions to the public of unprofitable lines, low tariffs, certain luxury in the rolling stock, etc. In the case of the supplies of electrical power more especially, greater freedom in negotiating contracts with important consumers has proved essential. Hard and fast tariffs are impracticable because large consumers, whom it is essential to secure, demand an individual treatment which necessitates discretion, and may be secrecy. The large staff of officials, chiefly in connection with a system of electrical tramways leads politically to delicate situations.

That seems to have hit off the troubles of Germany and applied them to Great Britain. What I suggest is that we should have greater commercial management in local authorities. Do not let it be thought I am casting any aspersion on municipal administration, but what we want is continuity of policy, and we shall never get that until there is a spirit of permanence. I would go further and say that in commercial undertakings of local authorities there should be some sort of devolution, whereby the powers of the council should be transmitted to the tramways or electricity or gas committee on a purely commercial basis. Taking a council of 60 members, 48 of them should not have the power, out of pure caprice, to upset the commercial management. If the powers were almost statutory on the part of the committee it would be a good thing for the undertakings.

On the question of new tramways, Leeds has adopted a system of goods traffic. I happen to be associated with the company which is carrying on the productive work. The tramways will carry 50,000 tons of material in a year's time. This is going to be a good thing. If it had not been for the Leeds Corporation offering to carry some of that material, the output of munitions would not have shown so great a volume as it shows to-day. In conclusion may I express the hope that we municipal people will always take a broad view of our administration. We owe it as a duty to those who are fighting for us. We have to take a broader view of things in order to get a harmonising influence in life, whereby we can all work together, not for the benefit of a section, but for the benefit of the nation at large. (Applause.)

Alderman BROADLEY (Halifax).—One cannot expect to follow the brilliant exposition of Alderman Spencer, but I hope that all tramway authorities will take the lesson he has sought to elaborate to heart. As having experience of tramway matters, backed by the ability of Mr. Spencer, one has gone into these questions more or less before the war. Since then the position has entirely changed. Rails which were bought in pre-war days at £6 a ton, one cannot expect to buy to-day at less than £10 a ton, and the price will probably remain at that figure for a few years after the war has closed. Labour for which we paid 10½d. to 11d. an hour now expects to be paid 1s. 6d. per hour. The labour which we got at 6½d. has jumped to something like 9d. an hour. We can expect prices to advance at least 60 per cent. What the interest on loans is to be is a matter for conjecture. One need not be surprised if two or three years from now, if municipalities are left to themselves, a rate of 6 per cent. may be required. It is all right for the big cities, whose concerns are profitable. In Glasgow, I believe, the tramway debt is non-existent. I wish we were all in the same fortunate position, but that is not so, and therefore it is open to the large tramway undertakings such as those of Bradford, Leeds, and Manchester to look after and help the weak. I hope the delegates will take into their consideration the wise things which Mr. Spencer has said.

Mr. A. ELLIS (engineer and manager, Cardiff Corporation Tramways.)—I have been highly interested in what Alderman Spencer has said. How the authors of the paper are going to reply I cannot imagine. Alderman Spencer has, of course, touched on subjects that are not in the paper. For instance, he has criticised to a certain extent something in the president's address regarding sinking funds. We should all like to do that, but we are not supposed to criticise the president's address, and I do not intend to do so. He has also touched on the supply of electrical energy, and he has incidentally referred to the Board of Trade Committee. I may take the opportunity of saying that many municipalities are looking on this Board of Trade Committee with a degree of suspicion. (Hear, hear.) We consider that as municipalities are more largely concerned with the supply and distribution of electrical energy and are interested from a national point of view, they ought to have more representatives on the committee. I am particularly interested because I am the chairman of the linking-up committee for the South Wales and Monmouthshire district. Like Cheshire and Lancashire, we are going to try whether, in course of time, the Board of Trade Committee will not be required, for we are able to discuss this matter and come to certain conclusions of our own. We agree, of course, that the production of electricity is controlled by certain facilities being available. You should have your generating stations near the coal and water. I suggest that the supply of water is equally, if not more important, than the supply of coal. In regard to the paper itself and the question of ordinary passenger fares, some may suggest that if the fares were cheapened there would be more riders. In our district we do not think so. We are of opinion that the working class people are so well off that they do not know how to spend the surplus money they have, and are quite prepared to pay increased fares, and that they have no desire for any reduction. In regard to workmen's fares, the restrictions laid down by Act of Parliament are most unfair and unreasonable. If the regulations for workmen's fares included the poorly paid clerk, one might see some reason in it. But to give the facilities to the workmen alone is giving a privilege to which they, as such, are not entitled. In regard to advertising, for many years we ran our cars without advertisements. Then there was a feeling that we should have a little more revenue, and we decided to have them. Personally I am against them. I do not believe in using tramcars as advertising hoardings. The value of advertising is decreasing to such an extent that we could do very well without the revenue now obtainable from that source. As to interest on investments, in our case all the surplus moneys have been invested. The interest accruing is put into the fund itself, as for example, the reserve fund, the depreciation fund, and other funds. The interest realised is added to the main moneys. As regards power expenses, this is a matter of great interest to undertakings

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throughout the country. We in South Wales are in a somewhat different position from most people. The tramway undertaking owns the power station. The Electricity Committee is the largest consumer, taking 75 per cent. of the total output. That will increase to, perhaps, 90 or 95 per cent. We treat our power station as a separate concern and treat the tramway and electricity undertakings as consumers. We charge these undertakings on the proper basis, according to demand, and allocate the costs to the power station. We fix coal at 12s. per ton. The price per unit is so much. For every 6d. of rise or fall above or below the 12s., we add to the price ·011d. I heard yesterday from a gentleman that they were paying 1·68d. per unit, plus 20 per cent. In a case like that they would be better with a separate power station. In regard to drivers, male or female, if they do not show improvements they are put back on the spare list. We do not give bonuses to the men. We consider that for the wages we pay we are entitled to get the best service. On the question of wages I quite agree with the authors that it would be desirable if we came to some arrangements, and I believe the executive of the Association have the matter under consideration. As to the Committee on Production, we look on it with a great amount of suspicion. We think it is a little bit worse than the usual type of arbitrator. An arbitrator, as a rule, splits the difference. The Committee on Production in the South Wales area has given ½d. per hour more than it has granted to the skilled fitters. It appears to us the employees have only to threaten the Committee of Protion and go before them, and the Committee say, "Yes, there you are." We desire to be fair to our employees. My committee feel that they are entitled to have a living wage, but they do not like the feeling that their hands are to be forced if these matters are sent to the Committee on Production. As regards accidents and insurance, we have always carried our own insurance, and we are in the position to-day that we have paid half the premiums that we should have paid if we had gone to a company. We have paid all our third party claims, the premiums under workmen's compensation, £600 or £700 for the costs of investigation and other charges, and in addition have saved £20,000. That is in 14 years. At the moment we have paid many items out of the insurance fund, and we have a surplus of £10,000. (Applause.)

Alderman R. T. Fletcher (chairman, Wigan Tramways Committee).—I have no desire to enter into the technicalities of the question under discussion. To my mind it would be of some importance if the speakers were to give us some solution to the difficulties that are undoubtedly forecasted for us in the future. For instance, we are told that the price of commodities will go up. There has been no suggestion as yet as to any steps that ought to be taken in order to prevent the undue increase of prices. We have been told in an admirable speech by the opener of the discussion that we can look forward to paying increased interest on future loans, and if it is all true it may be anything in the region of 8 or 9 or 10 per cent. I agree that that would be a very big burden to the tramways, but why at a conference like this should not some conclusion be arrived at? In a company of wise men solutions ought to be found. I think if we had Lloyd George among us in a financial predicament a solution might be found. (Laughter.) It seems rather a joke to you (laughter), but we might take a leaf out of his book. For instance, why should we pay interest at all on borrowed money? (Renewed laughter.) I am going to make a suggestion that will some day be adopted, and you will not have your noses at the grindstone all the time paying moneylenders' interest. Since paper has been adopted as a means of exchange, and it costs only 2s. a thousand notes, why should there not be a demand made on the Government to stop this fleecing of municipalities in the shape of paying interest? Why not issue notes, "Wigan Corporation, 1917, to be repaid out of profits or from the rates." There is no need to dishonour or repudiate sinking funds and so forth. (Hear, hear.) There is no need to do that if you can only get at the source of your great troubles and stop the interest-mongering that is going on. The great fight of every community has been the enormous amount of interest that they have to pay. Since municipalities own tramways and other undertakings for the public good, there is no reason why the Government should not help all such authorities by making it no longer necessary to pay exorbitant sums in interest. Paper will pay as well as gold for local distribution. A one pound note I will accept at any time myself. (Laughter.) With respect to wages, the general impression is that the time has come when you have got to stop the working man from going for more wages. Do you not think it would be much better if you found some solution to the necessity for more wages, if, for example, the price of flour is reduced, the price of other commodities, increase. When the men come before you with the list of what they have got to find, you cannot turn your backs on them. In every rising market there will have to be ever-increasing wages paid, and it seems to me you would be serving your purpose far more valuably if you were to tackle the solution of the ever-increasing price problem.

A Member.—It is not our business.

Alderman Fletcher.—It is our business. We are here to pass resolutions and pull the strings and propagate principles.

Bailie M. W. Montgomery (chairman, Glasgow Tramways Committee).—Perhaps as a young member of the Association you will excuse me if I offer a few observations. I quite agree with one of the previous speakers who says that if we are to obtain any direct benefit from this paper it will be necessary for us to confine ourselves as far as possible to the subject matter in it. Some of the subjects which have been mentioned are extremely interesting. Still I think it is only by keeping to the point and trying to get it unravelled that any real and lasting result will be got from this excellent paper. One question raised by the paper is how to meet increased costs. The suggestion in the paper seems to be that we should apply to Parliament for power either to abolish or to modify the limitations which Parliament has imposed. On that I do not agree at all with the conclusions arrived at by Alderman Spencer, who thinks that all the restrictions in regard to fares imposed by Parliament should be removed and that tramways should have an entirely free hand. I believe that in some undertakings it will be necessary to increase the fares, in order to meet the great advance in the price of materials and increase in running costs, but that local authorities or companies should be allowed to charge what they like is a proposal from which I strongly dissent. Another question is whether a reduction of fares would meet the situation. That in Glasgow is our experience. Our experience very clearly has been that as we reduced the fares we increased the traffic, and also our revenue. Some five years ago we had halfpenny stages, each of which measured rather more than half a mile. We doubled the halfpenny distance by giving two of these stages, and from that date to this the returns have gone up by leaps and bounds, the number of passengers has increased enormously and our earnings per car-mile have increased, and the net profit has also greatly increased. I am aware that these conditions might not apply to every tramway undertaking. Whatever conclusion we arrive at it will have to be viewed in the light of local conditions. It is at the same time interesting to know that since we cheapened our fares we have had this very remarkable result. At the present time we are earning something like 11·59d. per car-mile, and we have a revenue of £1,250,000. I do not state that in order to boast about Glasgow, but to show that, in some cases at least, by cheapening the article you can develop the traffic and increase the revenue.

Mr. R. J. Bishop (vice-chairman, Walthamstow Tramways Committee).—I think it may be interesting to make one remark on that part of the paper relating to increase in revenue by revision of fares. We in Walthamstow spent a considerable time in considering the matter, and concluded by abolishing the ½d. fares, and an urban district council which has been referred to by one speaker as small fry set the example to the whole of the London area. The abolition of ½d. fares has been a great success and has turned a serious deficit into a surplus. In regard to the proper price that ought to be paid for electrical energy, I am afraid many of the figures quoted have touched more on the price for general supply and not on the charge for a tramway supply. In cases where tramways do not own their own power house the electricity department supplies the energy. We in Walthamstow spent many years on this subject and had some considerable controversies, but we evolved two years ago a formula which has worked very successfully and, I believe, very fairly between the departments.

The formula for fixing the cost of electrical energy to a tramway department is as follows:—

A.—Let A equal the cost of coal per unit sold.
B.—Forty per cent. of the said coal-cost for the extra cost of generation for traction purposes.
C.—Other works costs per unit sold. (That includes the whole of the works costs with the exception of distribution costs, which the tramways find themselves.)
D.—The cost of loan repayments and interest on capital expended (less distribution) per unit sold.
E.—·05d. for depreciation and contingencies.
F.—The number of units used for traction purposes.
G.—The annual cost of loan repayments and interest on the loan for traction plant.

X.—Total sum to be charged to light railway undertaking.

If you add A, B, C, D, and E together, and multiply by F and add G, you get the total sum to be paid by the tramways. I believe the cost at present works out at the same price as it was when coal was much cheaper than it is at present, and the electrical department are satisfied of its fairness.

Mr. W. Murray (manager, Walthamstow Council Tramways).—The paper which we are discussing is practical and to the point. Some seven years ago, in connection with power consumption, I had meters fixed on the cars. The average consumption then was 1·37 units per car-mile. For the next twelve months it was 1·18 units, meaning a saving of £1,200, while the total cost of the meters was only £140. If we had scrapped the meters at the end of twelve months we would have been in pocket, but we have a guarantee of twenty years on them. With regard to accident compensation, for a number of years we insured against third party risks, and insurance companies continued to increase the premium on these risks until the Council thought they should take the risk on their own shoulders. During the last five years we have carried our own risk, and in that period have saved nearly £7,000. There, again, I think the authors of this paper have been well advised to

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recommend that Corporations should consider the taking over of their own tramway accident risk.

Councillor D. D. Irving (vice-chairman, Burnley Tramways Committee).—It seems to me one aspect of the case under consideration has almost entirely been lost sight of. Any person entering this room and listening to the discussion could not have imagined that this was an Association of municipal tramway people. What they certainly could have assumed with confidence was that we were an association of company-owned tramway concerns whose reason for existence was the purpose of making profit. Without in any bad sense attacking privately owned tramway systems, the sole reason for the existence of tramway companies is to exploit a public necessity or convenience solely for making profit for the shareholders. Quite obviously the reason, or what ought to be the reason, for the municipal tramway system is to meet the requirements of public utility at the lowest possible cost, and as far as possible to the exclusion of profit altogether. (Hear, hear, and cries of "No.") Some people say no, but it is not so very long since you had to pay for travelling along your roadways. It is not so long since you had to pay for travelling over bridges. We have progressed since those times, and those barriers to progress at present have almost disappeared. (A Voice: "No.") Well, practically so. The remaining ones could easily be retained in some third-rate museum as specimens of the bad old times that have gone. Those who live long enough will see the tramways perfectly free for those who desire to travel on them as the roads are to-day. Look at the vast amount of labour, a very expensive commodity to-day, that is involved in the printing, circulation, and collection of tickets, and the clerical work attached to the whole arrangements of fare charges. By an alteration in the system of fare charges over the whole country there could be an enormous saving.

There is another point of view which a municipality ought to take into consideration, and which no private company could be expected to entertain at all. Surely we have arrived at a stage in our existence when we know that a cheap tramway system—and the cheaper the better from this point of view—is conducive to the scattering of the population, the elimination of congested areas, and the possible improvement of that national disgrace—housing for the great mass of the people. Your tramway system should be an exceedingly valuable aid in building up the public health and public happiness. I have not intervened in this debate to urge any revolution in connection with tramway work, but whatever tramway managers may think, they have approached the subject from the point of view perhaps of those who were brought up in the bad old school of company management, and cannot get out of the training. The municipal tramway manager, even if he has not had that bad schooling, is surrounded by people who have no other object in life but profit-making, and so that environment reflects on the manager. But I would hope that members of municipal corporations who are not so bound up with that point of view would realise as the important factor that public utility and helpfulness are superior to the question of profit.. There are many ways in which a municipal tramway undertaking can be made to contribute to public well-being, other than earning profit for the relief of rates. For instance, it can be used for the breaking up of our congested areas of population in connection with housing schemes, and become instrumental in a large degree to increase the measure of public health and happiness. A return of the kind, impossible to estimate in the term of "fares," is nevertheless an extremely profitable "return" in the best sense of the term.

Councillor Fryer (Birmingham).—There are just two points I would like to make in connection with this paper, and the first is the danger under which the authors seem to be of regarding a tramway undertaking as a separate business undertaking. I think it is impossible that a municipal tramway undertaking can ever be regarded as other than part of the municipal administration of the town. When the authors recommended that all concessions and privileges with regard to fares shall be done away with, I think those of us who are municipal administrators have a right to consider whether that would be in the general interest and well-being of the town as a whole. In the large provincial cities the old housing conditions were bad. We in Birmingham have at present from 40,000 to 50,000 back-to-back houses. In such a case we say it is distinctly in the interest of all concerned that the population shall be spread out and that a very real part of the profit of the tramway undertaking is reflected when you improve the surroundings of the working people. There I should join issue with one of the statements put forward by Alderman Spencer this morning, that the committees of local authorities should have very much larger powers, independent of the authority of the Council, because that way lies the danger of government by water-tight compartments. I agree with what the representative of Burnley said a few minutes ago, that we have to remember that the health and well-being of the people are among the chief considerations. I think it is worth while remembering that a term is often used, which is quite mistaken, namely, the term "trading undertakings." It is all very well to speak of a trading undertaking when it is brought into being and run for the benefit of a company, but when it is part of the municipal machinery of the town it is of the nature of a great public service, and what it contributes in the service is its justification. I am with the authors of the paper in believing that the affairs of these undertakings should be so conducted that they are on a sound and stable basis. I would regard it as deplorable that a tramway undertaking should be a charge on the rates, and I think when there is a clear case in virtue of extraordinary circumstances for altering your fares you should alter them boldly on a business-like basis. I do not believe that any well-guided Council would oppose its tramway committee in a judicious increase of fares if it was shown that the finance depended on some increase.

The two points I wish to make are these—that we should not regard a tramway undertaking as being a separate undertaking, but part of the great municipal service, and second that we should consider that it is abundantly worth while to divert some of its profit in securing the welfare of the people. In the first place, the undertaking should be maintained on a sound stable financial basis. In the second place, its management and those operating it should be reasonably and properly remunerated and enjoy decent human conditions of service. Having secured these two considerations, the profits of the undertaking ought to be largely reflected in added benefits to the user. If this conference is of opinion that that is a sound philosophy to underlie such an undertaking, it seems to me that it will agree to the policy expressing that philosophy involving some differentiation in fares—workmen's fares and children's fares—seeing that we desire to spread out our population. The whole principle of town planning and new housing depends on our spreading out our population over a wider area. People are housed in the north of England and in some of the larger Midland cities in such a way as to cast a reflection on our common civilisation, to say nothing about our common Christianity. In some of our towns people are living 100, and as much as 150 and 200 to the acre. Where I come from there is one of the finest examples of town-planning, that is Bournville—perhaps the most beautiful estate in the world. If the whole of the workers in this country were housed as they are at Bournville, about nine families to the acre, it would only require one-sixty-sixth of the land of the kingdom to enable the population to be so housed. So I believe in harnessing the activity of the tramway undertaking to the greater work of housing, even though it seems to me that we are carrying people at a loss expressed in money, for we are securing greater benefits of municipal administration and are helping the people generally to a higher standard of life. (Applause.)

The President.—Before closing this discussion we should very much like to hear our friend, Mr. Goodman, from Australia. He will likely have something very useful to say. (Applause.)

Mr. W. G. T. Goodman (chief engineer and general manager, Adelaide Municipal Tramways Trust).—I feel very much honoured in being called on to take part in this discussion, and also in being invited to be here to-day with you. One or two little details in connection with this paper have indicated to me that you might like to hear what our conditions are, and what we do in South Australia. In the main I agree with the contentions of the authors of the paper.

With respect to workmen's fares we, as you know, are subject to a great deal of labour legislation in Australia, and in some cases provision has been made that low rates have to be charged for the so-called workmen's cars. We in South Australia have not adopted any such principle, because we do not consider that because a man goes to work at a slightly earlier hour than other workers he should have a concession. We find that the artisans are well paid, and in some instances better paid, than the clerks and shop assistants, and we do not see why the man who is better paid should, simply because he goes to work an hour earlier, travel at a cheaper rate. It is only taxing those who go at the later hour to pay for the workman who goes at the earlier hour. Personally I think it is wrong in principle, and there is no justification for imposing this burden on the tramway authorities.

The second point is the question of children's fares. The authors recommend that the general principle should be to allow children under three years of age, not occupying a seat, to travel free. With that I agree, and it is the principle we adopt out there. We make a rule to carry children for a penny over any three consecutive sections. That is, if a child goes over six consecutive penny sections he pays a twopenny fare, and if over nine sections, a threepenny fare. That is for a child between three years and twelve. Our idea in making that concession is that if we allow the children to travel at a low rate of fare, it induces the mothers to travel with them, and we bring about an increased traffic during the flat hours of the day, and this is especially noticeable in the summer.

The third point is the question of power consumption. I note that the authors recommend that meters should be adopted for the cars. This is a matter to which I have given a great deal of consideration, but our difficulties in Australia in operating are somewhat greater than you gentlemen have to contend with here. On many of our cars we have to change the crews no less than seven times during the day. Men have to be relieved for meals, and the spread of eighteen or nineteen hours is more than the two shifts of eight hours; consequently, we have an intermediate shift, so that the crews are changed no less than seven times. I think it would be impossible in such circumstances to have any satisfaction by adopting meters on the cars. We do find that a great service is

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rendered by having proper motor inspectors, whose duty it is solely to watch the driving and controlling of the motormen. One point raised by the authors is that the elder man as a rule makes the more efficient motorman. In some cases this is so, but in the majority of cases we do not find that that is our experience. We find that the men get careless. Familiarity breeds contempt, and they cut up into parallel before they should be off the last series notch. In most cases we have to deal more with the older men as to the extravagant use of power than with the younger man in the service.

The fourth and most important point I have to mention is the suggestion that there should be a properly constituted authority appointed to settle matters in dispute between employers and employees. No doubt many of you know that we have such an authority in Australia—not only one but a great many authorities—and the system works fairly well. It relieves the tramway authorities of a great deal of responsibility, but if you have such an authority to fix the rates of pay, there should be some other authority to fix the rates of fares, in order to meet the extra demands for wages. (Hear, hear.) We find as we go on year after year that our operating expenses increase. Why? Simply because every time there is a dispute between employers and employed they go before the proper tribunal, which awards an increase of wages, and we are not allowed to increase our fares, or we are not supposed to. Fortunately my board have decided, owing to the increased cost of wages, which has been very material within the last few months, and the increased cost of materials due to war conditions, to raise all fares a halfpenny. The penny fare is 1½d. now, and a halfpenny is added to all other fares.

The fifth point is accident insurance. The authors said that it is more satisfactory for their undertakings to carry their own risks. With that I absolutely agree. We found that up to the present, if we had insured against third party risks, after meeting all disbursements and premiums which we were asked to pay, the insurance companies would have had a profit of £30,000. We carry our own risk, and we pay about 1 per cent. of our revenue to meet all charges—that is legal expenses and compensation—and we now have a fund of over £10,000. As you know, we have been in operation for only a few years—about eight. The whole system has been in operation on an average for about four years. I thank you very much for allowing me to take part in the discussion, and I wish to express my appreciation of being allowed to be present, and my congratulations to the authors of the paper. (Applause.)

The President.—Before I bring the discussion to a close and invite the writers of the paper to reply, I would express my personal obligation to those gentlemen for the splendid manner in which thay have prepared it. I am quite aware that the title of the paper and its subject are not on the lines which were first suggested, but it really has met a great deal of what I had in my mind, and what was in the mind of the Executive Council, when the authors were invited to spend their time on it. The criticisms which have been made have not gone to the root of the problems that are really named in the paper, so as to give us a practical result in dealing with these questions. The question of raising the ordinary fare has not been adequately dealt with by the critics. We know that a great many of the undertakings have a reserve fund for putting their business on a sound financial footing, if they can persuade their Councils to take advantage of the Parliamentary powers they already possess.

With regard to workmen's fares, I am rather surprised no one has pointed out that the workmen's traffic ought to be—and I believe is in most undertakings that have realised it—a most profitable traffic, because workmen travel in large numbers in one car. You always have a full load, and therefore it is always a very profitable load, so that the idea that workmen's traffic is unprofitable is entirely wrong. That pre-supposes that you have a sound basis of fares for the workpeople. It is a profitable thing to encourage the workman to travel about. If he travels to his work on the car he will travel for his pleasure on the car, and you are creating a traffic which will never leave you.

Then the difficulties of differentiation might be more properly brought up on Mr. Murray's paper. We know from our own experience at home about differentiation between ordinary passengers and clerks, shopkeepers, shop assistants, and even cloggers. The latter classes all travel daily at labourers' rate, and they *are* differentiated from the ordinary passengers. Further, there is the practice of allowing everyone to travel at workmen's fares up till eight o'clock in the morning, because I suppose the difficulty of distinguishing ordinary passengers from the workpeople has not been got over. In our district the artisan, mechanic, and daily labourer can travel up till nine o'clock at workmen's fares. The ordinary passenger, even if he turns out at 5.30 in the morning must pay the ordinary fare, and we have no difficulty in carrying out that practice. (A Voice: "That is wrong.") It may be wrong.

The writers of the paper rather deprecated parcels traffic, though that is very profitable traffic if properly managed. We have carried parcels ever since the institution of the tramways, and our net profit is 75 per cent. on the total income. The parcel work should be incurred not only for the profit, but because it is a great convenience to the people to have the use of the cars for the parcels. With regard to working expenses, I do not propose to go any further because of want of time; moreover there are so many heads in this paper which might make separate papers in themselves. I will conclude by expressing my high appreciation of the paper, and ask the writers now kindly to reply. (Applause.)

Mr. G. W. Holford (general manager, Salford).—Mr. Barnard and Mr. Priestly have asked me to reply. We desire to express our pleasure and satisfaction at the friendly manner in which the paper has been received and with the interesting discussion which has taken place. Our main object was to raise a discussion, and I think we have raised a very interesting one. One of the privileges we have enjoyed was to listen to the excellent address by Alderman Spencer. When we were asked to write the paper we were set certain limits and we were not supposed to travel so widely as Mr. Spencer, who dealt with national finance with some slight reference to municipal finance. With all respect to Mr. Spencer, perhaps his address would have been more fruitful if given before the Municipal Treasurers' Institute or the Municipal Association, because we tramway people have very little control over the investment side of the undertakings. Usually Corporation loans are dealt with by some other committee of the Corporation. We all know Mr. Spencer is a high authority on finance, and I am hoping after hearing him this morning that the Government will not look very far afield and will rope him in as an adviser on the financial side, and I am sure he will give excellent service. (Hear, hear.) Mr. Spencer did refer to two or three items which we have mentioned in our paper. Generally he did not contest the views we submitted in regard to increase in wages, cost of materials, etc. Mr. Ellis referred to the Electrical Committee, and I may say the Executive Council are endeavouring now to obtain an increase in the representation of municipal authorities on that committee. Mr. Ellis hardly understood the reference we made to investment or to the interest which accumulates on various funds of a tramway undertaking. In some towns interest accrued on various funds is put to the borough fund, and where there is a renewal fund the interest is not put to that fund, but probably to the tramway fund itself. We are of opinion that each fund should benefit from the interest which accrues to it. (Hear, hear.) Alderman Fletcher, of Wigan, submitted some rather novel suggestions for dealing with money. I am afraid our time is too limited to follow him closely. It appears an excellent idea to be able to do anything with a piece of paper stamped with the name of the Borough of Wigan on the top, and we shall be pleased to have full details as to how to work that out. (Laughter.) Alderman Fletcher also referred to the cost of food and said no speakers had referred to the root evil, the increased cost of living. I think that is rather outside tramway departments. It is a national question and it has been deputed to eminent gentlemen—Lord Rhondda and others. It is too much of a national matter to be dealt with in a tramway conference. I was pleased to hear Bailie Montgomery, of Glasgow. We always hear of the wonderful results obtained in Glasgow which make us, I am afraid, rather envious at times. Although they say that in Glasgow they get better results if they reduce their fares, that does not follow in other towns. Even in London itself they have had to withdraw some of the cheap fares. Mr. Bishop, of Walthamstow, told us of the length of time they had spent in revising their fares there. It is generally a topic which causes a good deal of discussion in committee, but I do not think the time was wasted, especially when we hear of the excellent results from abolishing the halfpenny fares, and now practically the whole of the London area has done likewise. I am pleased to hear that. I was also glad to hear from Mr. Murray the excellent results of the insurance system and also that he supports our views with regard to car meters. I was rather sorry to hear some of Councillor Irving's remarks. I think he rather misunderstood some of the speakers if he thought that we are all out for profit making. I do not think we have that idea. The writers of the paper certainly have not, but we do think we are justified in avoiding losses (hear, hear), and after we have avoided losses we are justified in creating and preserving reserve and renewal funds. After that I am not particular whether the profit goes to the rates, or to cheaper fares. I hope you will be a long liver, Mr. Irving, but however long you live, I hope you will not see free travelling. At any rate, I should not like to manage a tramway with free travelling. (Laughter.) We have to look first for other essentials of life, such as free water and free food. We are highly honoured to have heard Mr. Goodman, and I wish to express my thanks to him for addressing us. It is quite interesting to hear the practice from "down under" and particularly to hear that in many ways they are in line with us. They are in advance of us in having a constituted authority for labour troubles, but I think that after the war we shall have such authorities throughout the country. I think the Whitley report will lead to that, and probably we shall reduce a good part of the trouble between employers and employed. We are very pleased to hear that the recommendation that we make in regard to insurance is followed in Australia with good results. Councillor Fryer, of Birmingham, suggests that we plead for a separate business undertaking. What we ask is that the tramways should be treated as a commercial enterprise, and I adhere to that. I do not think that it should be exploited by other departments or by the ratepayers when there is no justification for giving money to the rates at the expense of tramway departments. I thank you for the very kind hearing you have given. (Applause.)

A vote of thanks was awarded to the three authors of the paper.

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Bailie M. W. MONTGOMERY (chairman, Glasgow Tramways Committee).—I am very sorry that Mr. Dalrymple, our general manager, is unable to be present with us to-day to introduce the discussion on the rule of the footpath. He had at the last moment very reluctantly to abandon his intention of being with us. The King is visiting Glasgow this week, and Mr. Dalrymple's presence is considered necessary there in order that traffic and other matters should be attended to. He has asked me to read the following notes to you on a subject which I hope will prove of interest to the conference :—

## THE RULE OF THE FOOTPATH.

BY JAMES DALRYMPLE
*General Manager, Glasgow Corporation Tramways.*

I have been asked by the Executive Council to open a discussion on the question of whether it is now desirable that pedestrians on the footpath should be requested to keep to the left instead of to the right. These notes are not in any way exhaustive. They are intended simply as an introduction to the discussion of a subject which I think is worthy of our attention at this time.

I have not gone fully into the history of the rule of the road or the rule of the footpath, and I am not prepared to say definitely why in this country it was originally decided that in driving we should keep to the left, and in walking we should keep to the right. We all know that on the Continent the rule of the road, that is the carriageway, is that we keep to the right. This rule, however, is not universal, even on the Continent.

In regard to the rule of the footpath, I am not sure how it is that throughout this country, since ever there was a recommendation on the subject, we have kept to the right, although on the carriageway we have always kept to the left. I have heard various explanations, one being that pedestrians in the olden time always met each other left arm to left arm, in order that the sword arm would be free. That may have been the origin of "Keep to the Right," and it may not. It is a fact, however, I suppose that for centuries we have kept to the right. It will be necessary, therefore, before we can hope to get a change introduced and made general throughout the country that we should be able to make out a good case.

In the first place it must be clearly understood that we, as a tramway authority, are only dealing with roads and streets on which tramways are laid and where footpaths are provided for pedestrians. That is to say, it is our business to look at the question from the tramway point of view. We are not dealing with country roads where there are no footpaths. In the case of country roads it might be argued that the proper place for pedestrians is on the right-hand side of the road. In fact, the recommendation to keep to the right may first have been made to meet the conditions on country roads. If this were so, I would submit that the conditions now prevailing on out city streets call for a reconsideration of the whole question.

The London "Safety First" Council which was, I think, brought into being by our old colleague, Mr. Blain, and for which he acts as Secretary, have had this question before them for some time, and they are extremely anxious to get the local authorities to recommend pedestrians to keep to the left instead of to the right.

I understand that quite a number of local authorities, not only in the London area, but also throughout the country, are in favour of the change. I have communicated with all the local authorities operating tramways in regard to this matter, and the following is a tabulation of the replies :—

| | |
|---|---|
| Number of letters sent ... ... ... | 87 |
| Number of replies received ... ... | 84 |
| Question not considered ... ... ... | 39 |
| Question considered, but no decision arrived at ... ... ... ... ... ... | 15 |
| Question considered and change approved | 15 |
| Question considered and sent on to Watch Committee ... ... ... ... ... | 11 |
| Change made ... ... ... ... ... | 1 |
| Objection to change ... ... ... | 3 |

So far as the carriageway is concerned, the number, variety, and speed of the vehicles using the streets is becoming more and more a source of danger, not only to the vehicular traffic itself, but also to pedestrians, and perhaps at no time have we had so many street accidents as we are having from day to day at the present time. We consider that vehicular traffic on our streets requires more strict regulation than has hitherto been given to it.

In the case of the footpaths also, the conditions are gradually becoming more inconvenient and more dangerous for pedestrians. When two pedestrians meet on the footpath it is well that each should know the proper side to take. It is somewhat awkward when there is any dubiety in regard to the matter. This, however, is not simply the case of one pedestrian passing another. We have to consider footpaths crowded with pedestrians where those who are on the right, or next the carriageway, are forced to walk along the kerb and, very frequently, require to leave the footpath altogether.

It may be asked what interest is all this to those who are using the carriageway ; it may be by horse-drawn vehicle, cycle, automobile, or tramcar. This question is, I think, of very great interest to those who are driving on our streets. Indeed it is being raised by those who are using the carriageway, and it is being raised purely on the ground of safety, not only the safety of the user of the carriageway but also and, perhaps, more particularly the safety of the pedestrians on the footpath.

We all know that the present practice of keeping to the right means that those pedestrians who are nearest the kerb must always be proceeding in the same direction as the traffic on the carriageway. That is to say, they have always their back to the traffic. If the present practice were altered, and pedestrians were asked to keep to the left, those who were proceeding along that part of the pavement nearest the kerb would always be facing the traffic on the carriageway.

I have no doubt that many of those present to-day must often, in passing along the street in an automobile or tramcar, more especially where the carriageway is narrow, have watched the pedestrians on the footpath and have wondered which one was going to step suddenly in front of the vehicle and possibly be injured ; and let your driver be ever so careful, it is sometimes impossible to avoid an accident. Pedestrians, generally speaking, are very thoughtless and absent-minded. Indeed, it is remarkable how few people, when about to cross a street, take the slightest trouble to look round.

In suggesting that pedestrians on the footpath should keep to the left, it is with the object of minimising danger. The result of the change would be that those pedestrians who are travelling with the street traffic would be next the buildings, and, should any of these pedestrians wish to cross the street they would first of all require to cross the pavement. They would thus have time to see if any vehicle were approaching, and the driver of any vehicle would also have an opportunity of anticipating trouble.

No doubt a number of objections will be urged against the proposed change.

(1) It will be contended that it will be impossible to get the change introduced into every town, and it will be very inconvenient to follow one practice in one town and the opposite in another. I do not think there is much in this objection. If a number of the larger cities and towns were to make the change the others would undoubtedly follow.

(2) Another objection will be that it will be very difficult to induce people to change the present habit of keeping to the right which has been observed for many generations. I am not sure that there is much in this objection either. On the contrary, I think the citizens would welcome a change at this time. The rule of keeping to the right has only been a recommendation. There is no compulsion in the matter. We have tried for many years, by means of notices fixed to the lamp posts, and in other ways, to educate people to keep to the right, but I cannot say that the efforts of the local authorities in this matter have been very successful. If a distinct break with the past were made, and people were now asked to keep to the left I think we would immediately see a very decided improvement.

(3) There is also the objection that it would be inconvenient to have a practice on the streets of a town which might not be followed on country roads where there were no footpaths. You will find, as a general rule, that pedestrians on country roads take the centre, or that part of the road which happens to be cleanest. The number of accidents to pedestrians on country roads caused by their going to the left instead of to the right must be practically nil. In considering a question like this we must take into account the numbers to be affected. In the country we have the single pedestrian or perhaps a couple. On the city street we have the multitude.

I trust that the tramway committees throughout the country will take up this matter. The position only requires to be brought clearly before the Watch Committees, who are as anxious to look after the welfare of the users of the streets as we are. We are making great changes in many walks of life in these days, and I think that this is a change that could be made with advantage to us all.

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The PRESIDENT.—I think you will agree with me that Mr. Dalrymple has put the case for the change proposed in a very simple, straightforward way. To make it useful I think we should conclude the discussion of this paper by a resolution in favour of a change as suggested by Mr. Dalrymple, that resolution to be forwarded to the Home Office and to the municipal authorities of this country.

Councillor T. CANBY (vice-chairman, Huddersfield Tramways Committee).—When the resolution in regard to the rule of the footpath was sent to the Tramways Committee in Huddersfield, we discussed the matter pretty fully, and the committee felt that something ought to be done. The main feeling of the members there was that it was more a national than a local thing. If it could be adopted generally no doubt it would be a great benefit to the country, because I am sure everyone here will realise that the present system is wrong. The present system suggests that we should be put into blinkers like horses, so that we should not see the traffic coming. I believe the best thing would be—and I believe it has been discussed for many years—to have the rule of the road altered

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and get on to the continental system. (Cries of "No," and "That is another question.") Take the West Riding of Yorkshire, where the towns are very close together. Suppose some of these towns adopted the new proposal, and others did not. The populations are so much intermixed that there would be a certain amount of confusion. I take it that if you could get all the people to walk on the proper side it would be a great advantage, but I think the best thing would be to get the rule of the road altered. If, however, that cannot be done, I am strongly in favour of the resolution you are suggesting, and I shall vote for it in the hope that something will be done. It is a good suggestion, and if carried out would be of great benefit to the community. When you are walking along the road and vehicles pass quickly and silently, and when you step off the footpath, there is great danger of being knocked down. I shall support the resolution provided an alteration in the rule of the road cannot be got.

Mr. H. E. Blain (operating manager, London General Omnibus Company and Underground Railways).—If I may say so, I think this is a matter which is of more importance to traction people than at first sight they would imagine. Mr. Dalrymple has mentioned the fact that it is the London "Safety First" Council which has been mainly responsible for bringing this subject before the public view. Many of you are probably not aware that in the metropolitan area there are over 46,000 street accidents in a year, of which over 800 are fatal. That being so, necessarily the question of accidents there is an exceedingly serious matter, and in connection with the company which I represent I found when I joined them four years ago that the accident record and the amount of money paid in claims were almost phenomenal. I dare not mention the amount for two reasons: one is that you probably would not believe it, and the other is that I do not want to tell you. (Laughter.) I felt that it was absolutely necessary that we should reduce both the number of accidents and the amount of claims; and when I say that in four years we have reduced our claims' costs by £50,000 per year, you will agree that there was room for improvement. (Hear, hear.) On analysing the nature of accidents, one thing became very prominent indeed, and that was the very great proportion of accidents which happened to people stepping from the near-side pavement as against those stepping from the off-side. I, therefore, had a considerable number of these accidents analysed, and found beyond a shadow of doubt, that if the rule of the footpath had been reversed in all probability three-quarters of these fatal accidents would have been avoided. While this paper was being read, Mr. Furness told me that almost 40 per cent. of the accidents in Blackpool occurred to people who were walking on the right-hand side of the footpath on the island pavements on the promenade. They stepped off the pavement and were hit at once by vehicles.

There seems to be similar experience in other towns, and it is a matter which should be modified. We are the most conservative nation on the face of the globe, and because we have got accustomed to walk on the right-hand side of the footpath, that is put forward solemnly by some local authorities as a reason why we should not vary the practice. I do not believe that this attitude confronted by hard facts can continue. The hard facts are there; it is for us to convince the local authorities that the change is not only desirable but absolutely necessary. I was exceedingly interested in Mr. Dalrymple's figures in regard to inquiries from local authorities. We circularised the local authorities in the London area and 38 of them are in favour of the change and eight are against it, only one of whom advanced a reason; the others appear to have neither reason nor anything else. (Laughter.)

I hope that this conference will pass the resolution which you have indicated. We saw the Chief Commissioner of Metropolitan Police, Sir Edward Henry, and found out his view. He says that, if the public demand for this change is justified by facts, he would be very glad to fall into line. I believe that, if this matter were discussed in the localities, there would be no doubt as to the result. All of us might with advantage take a greater interest in this "Safety" movement. Putting it on the very lowest basis, you will find that your accident costs are enormously reduced, and what is of infinitely greater importance, you will find that the risk to the public has also been reduced. The London "Safety First" Council has not been in working operation for more than nine months, but we are more than satisfied with the results so far as London is concerned. Notwithstanding our darkened streets, the accidents all over the metropolis have been reduced very materially, and I believe this improvement is very largely due to this campaign. We have got almost all the traction undertakings—including the railways—and the owners of street vehicles and most of the carrying companies connected with it. I should very much like to see the campaign taken up by the tramway undertakings all over the country.

Alderman Sir J. Courtis (chairman, Cardiff Tramways Committee).—Cardiff is one of the authorities which have approved of Mr. Dalrymple's suggestion, and I think we are indebted to him for bringing the matter so prominently before the Association and the local authorities. What has struck me as surprising is that out of the number of local authorities to whom Mr. Dalrymple wrote 39 have not seen fit to make any reply. I think that shows a lack of courtesy on the part of these authorities. I am interested in what Mr. Blain has said, because he is an authority whose opinions we all respect. We have in Cardiff a street where numerous accidents have taken place for the very reason mentioned, namely, people stepping off the narrow footpath at a place where there is a narrow roadway. We hope after the war to widen the thoroughfare. At present we are meeting with the difficulty of accidents occurring constantly. People step off the footpath without thought; you cannot blame them; one is often absent-minded in walking along. I hope the Home Office will be approached; I think that is the authority which should be tackled on the subject. A deputation should wait on the Home Office and point out the desirability of making this change, because I think the Home Office should issue a much stronger instruction to the head constables to see that the rule of the road is observed more than it is. Many of us find horse vehicles in particular on the wrong side of the road. We have had instances innumerable. Many of the horse vehicles and some of the motor vehicles are closed in so that the drivers do not see anything that is going on behind them, and they do not take the trouble to find out what is behind. They keep to the middle of the road, and when a motor vehicle overtakes them the driver thinks he is safe in taking the wrong side. The other driver, hearing an approach, pulls over, and an accident results. If the local authorities would do more in attending to this, and do less in summoning motor drivers for having too much light or for having a dull light, and if they would see to the people keeping to the proper side of the road, many accidents would be prevented. I have much pleasure in moving that a deputation from this Association wait on the Home Office and make a strong case, and I hope Mr. Blain and others will take part in the deputation. I think also that we should circularise the local authorities at the same time.

Mr. A. H. Scott (Highways Committee, London County Council).—I rise with some diffidence about supporting the resolution. It is not that I am not heartily in sympathy with it, but I believe that if we went as a deputation from this body to the Home Office we should not meet with the result we hope for. I think the resolution ought to be sent to the Municipal Association. The matter ought to be dealt with by our different municipal tramway committees, and they ought to present it to their Councils, and to get from the Councils an expression of opinion. That united opinion expressed, not through an individual Tramway Association, but through the Municipal Corporations, will achieve, I am sure, a result much better than representations from this Association, important as it is. I want to see this change put into operation, and I am only throwing out the suggestion because I do not think the present proposal is the best way to achieve the aims we all have in view.

Alderman T. P. Griffiths (chairman, Southport Tramways Committee).—I think this is a matter in which we shall progress most rapidly in approaching it slowly. We have to deal with very old customs. The state of traffic on the streets arises from the plain fact that the public will not observe what are supposed to be the rules of traffic. Neither in walking nor in driving are the rules observed. Then when we get to the magistrates they find they are not supported fully by the law. One gentleman has suggested that the best body to act is the Municipal Corporations' Association, and I believe that you will proceed more rapidly by going to the Municipal Corporations' Association than you will by simply sending a deputation to the Home Office from a section such as the tramway interests are. We are liable to be met by prejudice. Unquestionably this would be a very great improvement, but we have to deal with old-established customs.

Mr. W. Murray (manager, Walthamstow).—I think we are getting into a difficulty. I think we should refer the matter to our Executive Committee to pass a resolution, send it to the Home Office, and pass it on to every municipal member of this Association. That would meet what is wanted.

Alderman Spencer (chairman, Halifax Tramways Committee).—I support the suggestion of a deputation to the Home Office. If you go to the Home Office now probably nothing will be done for six months. They do not move very swiftly. If you adopt the suggestion we could do a good deal by educating the local authorities in the intervening six months. I am one of those who have not thoroughly appreciated the importance of this subject. I have heard more to-day from Mr. Blain of a convincing character than I have heard for a long time. What we all need to-day is for the municipal tramway authorities to get accurate statistics during the next few months, and then we can try to educate the whole of the municipalities and get them to move through the Municipal Association with the Tramways Association behind them. If we try to move the Municipal Corporations' Association on the subject, we are going to have a pretty tidy job. It is not easy to do it. I have found in dealing with that body, that unless it is something which touches the law you do not move them very quickly. This is a general public question and we need to educate. Let us do so until we do stir up the Home Office.

Councillor R. J. Bishop (vice-chairman, Walthamstow Tramways Committee).—We know that there is a law for vehicle traffic on our roads, but I have yet to learn that there is any law that a pedestrian has to keep to the right. We know that notices are put up—"Keep to the right"—but I do not think there is any compulsion that a pedestrian should do so. Therefore, why should we go to the Home

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Office and get this altered? It is a question for the municipalities themselves. London is slightly different. In the metropolitan area we are under the Home Office. I do not think in Bradford you have to go to the Home Office to get permission to put up notices—"Keep to the right." It is a matter for the towns themselves. We know it has been the rule for centuries to keep to the right, a sort of unwritten law, but I am afraid pedestrians do not follow it. I think one object lesson is the bridge at New Street, Birmingham. It is always full of pedestrian traffic, there is a "Keep to the right" notice, but if the authorities want to get the pedestrians to keep to the right they have to have a policeman at each end to make them do so. The matter is in the municipalities' own hands. That the change is desirable, one may almost say necessary, is undoubtedly the fact, but I think if we adopt the first suggestion of passing a resolution we should communicate, not particularly with the Municipal Association, but with each municipality in the United Kingdom. In that way we should do better than we should do either by having a deputation or anything else to go to the Home Office. The whole thing is summed up in Alderman Spencer's phrase—"Educate your people to keep to the left"—and I do not think you will have any need to have a law made for the purpose.

Councillor E. HEAP (chairman, Burnley Tramways Committee).—I have great pleasure in seconding the resolution. After the discussion and after hearing the statistics given by Mr. Blain, I quite realise the responsibility. I had realised it in Burnley, but more since I came to Blackpool. I was absent-minded last night walking along the Blackpool streets and was very nearly trapped by a tramcar; it was entirely my own fault, but if I had been going the other way I should have seen the car.

The PRESIDENT.—The Secretary will carefully draft the resolution, but it is simply a resolution on the lines of Mr. Dalrymple's paper, with instructions that it shall be forwarded to the Home Office and the municipal authorities.

The resolution was carried unanimously and a vote of thanks was accorded to Mr. Dalrymple.

## DIFFERENTIATION IN FARES FOR WORKMEN AND OTHER PASSENGERS ON TRAMWAYS.

By MR. WM. MURRAY, Assoc. I.E.E.
(*Tramways Manager, Walthamstow Urban District Council*).

The subject on which I have been asked to submit a few notes at this our Annual Conference is not one, I fear, likely to excite breathless interest on the part of any of the delegates present. Whatever attention it may receive will probably be that of calm and judicial consideration, rather than of either enthusiastic advocacy or dogmatic condemnation. The evil to be dealt with may seem at first glance to be of comparatively little importance; but the principles involved are of grave moment, and the results in some cases very far-reaching. Personally I think it is one which is worthy of serious consideration. With many of us the problems of how to increase revenue, and how to check the growth of expenditure, are likely to become more and more acute as time goes by; and the question of "Differentiation in Fares," as I shall attempt to show, very materially affects the first of these propositions.

There is taking place in these days an almost imperceptible, but at the same time a very real, change in the position of many municipal tramway undertakings throughout the country. This change is a third phase in the history of tramway development. In the early days we had horse haulage, high fares, and, speaking generally, profitable financial results. With the advent of electric traction we secured greater speed, better vehicles, increased comfort for passengers, immense popularity, and satisfactory returns. Now, at the present day, we in London at least, are being seriously challenged in the matter of speed; are meeting with keen competition in regard to fares; and are being brought face to face with such enormously increased expenses that it behoves all concerned to consider carefully the difficulties which lie ahead, and to use every effort to put our affairs in order, so that the very best financial results may be obtained from our respective undertakings.

The tramcar still "holds the field" as the most efficient mode of street passenger transport for towns and large urban districts; but the conditions of operation are changing rapidly, and new arrangements must be made to meet these changes. Whether among these new dispositions there should be a departure from the recognised policy hitherto followed of granting special and privileged terms to certain classes of passengers is the subject which I propose discussing in the following notes.

Differentiation in tramway fares, in favour of *bona-fide* workmen, has been made compulsory by all Special Acts and Provisional Orders granted under the Tramways Act of 1870. Presumably, in the first instance the "powers that be" considered that, as they were granting at least a partial monopoly in street passenger transport, it was a fitting opportunity of securing for the working classes exceptionally cheap travelling facilities, hoping thereby to assist them to a better and brighter environment for their home life, and for the upbringing of the rising generation.

Now, admirable as this intention may have been, I think that the method adopted was distinctly open to criticism. I submit it was simply a decision to confer benefits on one section of the community at the expense and to the disadvantage of the other.

While tramways were in the hands of private owners it was recognised that to run a service of cars at the compulsory workmen's rates meant *running at a loss;* and because of this such services were kept within the very narrowest possible limits. In many cases one car on each route, running a single journey only—at about 6 a.m.—was all that was provided, the ordinary service coming into operation about 8 o'clock. At the same time, great efforts were made to prevent passengers other than workmen from profiting by these cheap fares. In many cases women were not recognised as "workmen"; and constant friction resulted from the companies insisting that all whose appearance seemed to indicate that they were something other than working men should pay the ordinary fares.

So determined were some tramway companies to go no further in this direction than they were actually compelled to do that I remember when the residents of one district in a certain provincial city petitioned the local company to run a car earlier than the ordinary service began (about 6.30 a.m.), in order to catch a London train, the company only consented to do so on the condition that it should be considered a "special" car, and that the fare should be 6d. instead of 2d. This arrangement was agreed to, and the car ran for years at the higher fare.

It is clear from the foregoing that the men who first took up tramway construction and operation as a business enterprise regarded the compulsory preferential rates for workmen as being inimical to the profitable operation of their undertakings; and, while submitting to the inevitable, did everything in their power to curtail the loss involved.

With the coming of municipally-owned tramways an entire change of policy was initiated in regard to this matter. Encouraged by the low operating costs of electric tramways, with a desire to relieve housing congestion in central districts, and to enable working class people to live in the outskirts, these services were increased to an extent never before dreamed of, and fares were reduced to a level much below the compulsory limit. The increase in the one case, and reduction in the other, has continued, until to-day in certain districts of London (and, I presume, though in a lesser degree, in the provinces also) there is a continuous stream of workmen's cars between 3.30 and 8 a.m., and special cars are run out between noon and 2 o'clock and again between 5 and 7 p.m., to cope with this traffic; and a rate of 10 miles for 2d. seems to be about the average. *In one instance passengers on these cars can travel for a distance of 19 miles at a cost of 2d.* I hesitate to make further comment on this state of affairs lest I should be tempted to use warmer language than might be deemed advisable. Indeed, I am finding that there is more excitement in this subject than I imagined when I began to prepare these notes.

Nor is this all, for owing to the difficulty of enforcing the "artisan, mechanic, or daily labourer" idea, many tramway systems allow *all* passengers boarding cars before 8 a.m. to purchase return tickets at workmen's rates; so that for about, say, one-fourth of the entire working day, all passengers travelling on these systems do so at rates which involve a loss to the undertakings concerned.

In many towns still further concessions have been granted, such as cheap fares for school children, free passes to the blind, free travelling for tramway employees, policemen, special constables, hospital nurses, wounded soldiers, and others, and it seems that the tendency in this direction also continues to grow.

Now I submit that in principle the whole system of differential fares, and free travelling, is utterly wrong; being unfair to the ordinary passenger, unfair to the undertaking concerned, and unfair to the ratepayers, who may some day be called upon to make good a loss—*an unnecessary loss*—on the working of their tramways. I submit that the only true basis for the fixing of tramway fares, as for the fixing of prices in any other business, *is the cost of providing the service rendered*, and that all who avail themselves of that service should be required to pay on a uniform scale.

Why should either men or women going to work at 8.15 a.m. pay twice the amount in tramway fares which others who start half-an-hour earlier are required to pay? The only good business reason would be that it costs less to run the service at the one time than it does at the other. But this is not so. As a matter of fact, many of these workmen's cars are "specials," run out for this particular traffic; and for several reasons familiar to us all these cost more to operate than the ordinary service cars.

Again, why should a highly-paid mechanic be carried for less on a tramcar than a clerk, or shopgirl, or charwoman? Why should schoolchildren have special rates? In my experience this latter only relieves middle-class parents from an expense which they are quite able to bear in sending their children to "select" institutions, some distance away from home, rather than less genteel schools nearer at hand.

Why should tramway employees travel free? They are usually better paid and more comfortably situated than other classes of working men, and the mere fact that they happen to be employed in the tramway service is no good reason why they should not pay their tramfares like other people if they wish to ride rather than walk. I have never been able to understand why a tramway clerk,



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fitter, or cleaner should be allowed to travel free, while the staffs of other departments, *employed by the same Council, are required to pay*. All such concessions are liable to abuse. On one occasion I saw a tramway employee, engaged on night duty, stop a car during the day, board it, travel for a short distance without paying any fare, stop it again when he wished to alight, and his errand was—*the getting of his dinner beer*. This may seem an extreme case, but it is typical of many which have come to my own personal knowledge quite recently.

In the early days of the war many tramway concerns allowed free riding to soldiers, sailors, and nurses; but joy riding became so prevalent, especially on Sundays, and the friendliness which in some cases sprang up, quite naturally, between the soldier and the lady conductor, became so marked, that the privilege had in many towns to be finally withdrawn.

Just here I wish to say that I give way to no one in my admiration for our men who have gone out and performed such glorious deeds in the present war; and I acknowledge unreservedly the indebtedness which we, as a nation, owe to them; but why in the name of common sense should tramways be called upon to liquidate, or assist in liquidating, that national indebtedness?

Again, why should a tramways undertaking, in supporting the wives and families of members of the staff serving with the colours, be called upon to carry ten times the financial burden which an electricity, water, gas, or other department does—simply because it has been able to surrender more men for national service than these other departments? That a Council should set the example to other employers by paying the wages of those who have risked all in the defence of the homeland, is right and proper; but that it should place by far the greater part of this burden on its tramways undertaking is neither logical nor fair.

What the public, and, I fear, even some Town Councillors, seem to forget is that travelling facilities cost money to the department furnishing these, *just as really as any article of commerce costs money to those producing or selling it*. Because of this, there is no more reason why the department should be called upon to supply free travelling facilities than free beer, or free anything else. In providing these facilities the undertaking has to buy cars, construct permanent way and overhead equipment, purchase or generate electrical energy, and hire labour. Now, having done all this, why it should be asked to sell the finished product at less than cost price—or, worse still, give it away for nothing at all—I cannot understand. I know of no other great industry, or branch of commercial enterprise, in which habitual selling under cost price has come to be recognised as the correct thing. In some businesses it may be that one article is sold at cost price or less in order to entrap customers, and with the hope of making a profit out of other goods which they are almost certain to purchase. Thus, in peace times a grocer may sell sugar at or under cost, *knowing* that customers will assuredly buy other goods also on which more or less profit is made. In such a case, although the morality of the procedure is doubtful, the result may be considered to justify the means. At any rate, the purpose is clear and understandable. With municipal tramways, however, *no such temptation exists*, as under-selling in one direction does not lead to increased profit in another, and from the same customers. It merely leads to a loss, for which the department proceeds to try and recoup itself by overcharging other sections of the community. To my mind this is not only bad business, but, from a moral standpoint, is simply indefensible. I am glad to think that, as shown by the various discussions which have taken place recently on tramway fares in general, it is clear that many gentlemen connected with the business are beginning to realise the folly and injustice of the course hitherto pursued, and to feel that a change of some kind is almost imperative. The fact that many of the larger tramway concerns have been so wonderfully successful as to be able to bear the burden is apparently the only reason why the evil has been tolerated so long, and why it has been allowed to grow to such an amazing extent. I think that, if ever stress of circumstances compels us to stir ourselves in this matter, it will be all to the good.

In the foregoing notes I have assumed for the moment that workmen's fares must of necessity involve a loss to any tramways undertaking. While, however, this is generally true, I do not know that it is absolutely so. Fares which result in a loss in one town may conceivably yield a profit in another. No universal dictum can be laid down in this matter. For example, we are accustomed to hear it stated, very emphatically in some quarters, that halfpenny fares *never* pay; and yet I think it must be clear to most people that, given a sufficient number of them, and an all-day spread-over of the traffic, ½d. fares are capable of yielding a very handsome return. Allow me to quote an example in proof of this statement. At Newcastle-on-Tyne a private owner runs a service of horse-drawn brakes over the high level bridge which spans the river, conveying passengers from Newcastle to Gateshead, and *vice-versa*. Only one fare is charged, viz., ½d. per head; and on each journey, in either direction, the proprietor has to pay a toll of 4d. to the owners of the bridge. In spite of this handicap, this service, *supported entirely by ½d. fares*, has been maintained for many years, and presumably does something more than merely pay its way. This owner, at least, has evidently found that ½d. fares are all right—provided you can get plenty of them.

The question of what pays, and what doesn't pay, must be decided entirely by local conditions; and the answer seems to be as difficult to arrive at as that to another I have sometimes had put to me, quite seriously too, viz., "How much does it cost to stop and restart a tramcar?" The fact is that the old adage that "circumstances alter cases" still holds good, and the point can only be decided by a careful survey of the facts relating to each individual undertaking. In my own case I have adopted a very simple formula, which I shall presently set out. It may not commend itself to some others, perhaps because of its very simplicity; but it has merits of its own, and it provides a *safe* basis for determining the "paying point" on any system. If there is anything better in use I shall be glad to know of it. The formula referred to is:—

Let C = total cost of operation, including interest and repayment of loan.
M = total number of car-miles run.
P = total number of passengers carried.
X = cost per passenger per car-mile.

Then—

$\frac{C}{M}$ = Average cost of operation per car-mile, and

$\frac{P}{M}$ = Average number of passengers per car-mile;

therefore— $X = \frac{C}{M} \div \frac{P}{M}$

$$X = \frac{C}{P}$$

Thus, in Walthamstow, we ran last year 1,128,029 miles, at a total cost of £48,952, and carried 12,367,778 passengers. Under the formula given this represents:—Cost of operation per car-miles, 10·415d.; number of passengers carried per car-mile, 10·964d.; therefore cost of operation per passenger per car-mile, ·95d. Of course last year was altogether abnormal, and but for the increased expenses, including payment of war bonuses, etc., etc., the cost of operation would have been very much less.

More than twelve months ago we raised our workmen's fares to the limit allowed by law, i.e., ½d. per mile; but even on this basis it is clear from the above figures that we are still losing nearly ½d. on every car-mile run at workmen's rates. We ran last year 200,000 such miles, and this, I reckon, involved a loss to the undertaking of about £3,750. *If this is so on a small system such as ours, what must the loss be on some others?*

In face of these facts, what, then, ought to be done? First of all, in my humble opinion, steps should be taken by all municipal tramway authorities—but more especially by those whose undertakings are having a difficulty in making ends meet—to raise workmen's fares to the legal limit of ½d. per mile, to cancel all free passes, and to withdraw all special rates. This certainly would only be a lessening of the evil, but it is a change which can be effected at once, without waiting for the doubtful results of organised legal agitation. If this cannot be done—if it is considered necessary for the development of the district, for the social well-being of the working classes, or for any other reason, that differentiated fares should be continued—then let the Council concerned purchase from the tramways department tickets or tokens, *at face value*, and distribute them at a reduced price, or entirely free, as they may consider desirable.

An arrangement of this kind would have several distinct advantages. It would free the tramways department from a very serious, and a very unfair, handicap in the conduct of its business; it would remove the injustice of fleecing one class of passenger in order to benefit another; and, perhaps most important of all, it would enable the public, and members of Council themselves, to appreciate the cost of such concessions—a thing which very few indeed seem to realise at the present moment.

Then I submit that the Executive of our Association ought to seriously consider what steps can, *and should*, be taken to secure an alteration in the laws regarding workmen's fares. If these were unjust thirty years ago, when tramways had at least a nominal monopoly of the traffic, how much more unjust are they to-day, when some of us are fighting against a competition which is under no such obligations, and which refuses—and wisely so—to touch this unprofitable business.

In discussing this matter it is almost impossible for a London tramways manager to avoid having in mind local conditions and difficulties, which are too acute to be even temporarily ignored. However, the safety of the whole can only be secured by protecting the interests of its parts; and after all London's difficulties of to-day may become the difficulties of Bradford, Leeds, Manchester, or Sheffield to-morrow. I trust therefore that the Conference will bear with me if I seem to take a somewhat local and narrow view of this matter.

I say then that, if tramways *must* go on bearing this burden of preferential fares for working men and women, then, in common fairness, they ought to be protected from a competition which is unequal, unnecessary, and grossly unfair. Electricity, gas, and water undertakings, whether owned by municipalities or private

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companies, are protected from such competition. Why then should tramways not only have the competition but be handicapped by impositions and restrictions which are altogether unreasonable and out of date? In view of the position at the present day the official description of the Act of 1870, as an Act "to facilitate the construction . . . . of tramways," reads painfully like satire.

Injustices such as I have pointed out, and others which are familiar to us all, are so glaring that it should be possible to secure redress, notwithstanding the vested interests, or official red tape, which may seek to block the way.

As I have already indicated, up to a certain point we can help ourselves; beyond that point we look to the Association to see us through.

I am convinced that if the Association is going to retain the confidence and support of municipal authorities throughout the country it must devote less time to the consideration of purely academic, theoretical, or even technical questions, and condescend to bestow its thought and energies on matters of more prosaic, but more pressing and general everyday interest. Because of this, while I regret that someone of larger experience and greater influence was not entrusted with the task of introducing this subject, I am glad to have had the opportunity of expressing my feelings on the matter; and I hope that, whatever deficiencies the paper itself may have, the discussion arising out of it may prove helpful to the members of the Association, and of material advantage to the industry in which we are all so keenly interested.

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Mr. MURRAY, in presenting his paper, said:—In my notes I have tried to express my opinion clearly and emphatically. When I promised to prepare this paper I realised that probably I was rushing in where angels, in the shape of some of the bigger men connected with the industry, feared to tread, but I feel very strongly that the things I have written ought to be written and ought to be freely discussed and ought to receive the utmost publicity possible within tramway circles. I do not imagine that we shall be agreed on all the points raised, but I do hope that we shall have an interesting and profitable discussion, which will bring us appreciably nearer some much-needed change in tramway law and practice. The gist of the matter in my mind is this, that it is altogether unfair and illogical to differentiate in tramway fares. I am thoroughly in sympathy with the idea of bettering the housing accommodation in our cities and enabling the workmen to live under better conditions, but I cannot see why, if that work is to be done, tramways should be saddled with the expense.

### THE DISCUSSION.

Councillor J. MOON (deputy chairman, Plymouth Tramways Committee).—I beg to express my thanks to Mr. Murray for his able paper, which I am convinced contains a lot of food for consideration, especially for tramway managers. There are certain things about which I do not see eye to eye with Mr. Murray. I do not agree that the paper is not likely to excite breathless interest on the part of the delegates. I think the fare question is one of the greatest we have to consider in connection with tramway work. How to adjust the fares so as to give satisfactory financial results, and yet study the interests of the ratepayers is a thing which should excite interest on the part of every delegate present. The writer of the paper refers to the problems, how to increase revenue and to check the growth of expenditure. We must be careful as tramway managers and members of tramway committees not to overstrain the point of revenue earning. Our duty is especially to consider two points, namely, a fair financial return, and the best and most efficient service for the advantage of the ratepayers. The Plymouth Tramways Committee, ten months ago, entirely did away with differential fares, and established a 1d. rate for any distance on any one car. This bold venture has so far been very successful. I quite agree with some remarks of the writer relating to the great competition with which tramway undertakings are faced, but surely, as tramway managers and committees our duty is to face competition by putting our best efforts and energies into our work in the way of improvements and economies, rather than by charging high fares. Perhaps my views of differentiation in tramway fares may not be in accord with the majority of tramway managers here. They are directly responsible for the success, or otherwise, of their undertakings, whilst I and other representatives of the ratepayers have to take a somewhat different view. We have to take a broader outlook. For that reason one has to consider the local conditions relating to parts of towns which are densely populated, and if the density of those areas is detrimental to the health of the inhabitants, it is our duty to try and remove some of those people to the outer areas of the town, even if it is somewhat detrimental to the finances of the tramway undertaking. I agree with my friend as to the folly of legislating for one section of the community by Act of Parliament. This class of legislation should be left to local governing bodies. As to return tickets for all people riding before 8 o'clock in the morning, surely, if tramway managers were to present to their committees the loss incurred by issuing return tickets at ridiculously low prices the committee would cease to do so. I think that, in towns where this has been done, it is very largely the fault of the tramway manager for being so weak-kneed. He certainly should have a stiffer back. (Laughter.) I feel satisfied that no tramway committee would go against their manager who showed them that they were running the tramways at a loss. The Plymouth Tramways Committee has been asked for, and has refused, cheap fares for school children, also free passes for inmates of blind institutions, and hospital nurses. These people apply on the score that they represent charitable institutions, supported by voluntary contributions, and play upon the sympathy of tramway committees. I take the view that, as public representatives, we are elected to our positions to do our work on business lines, and not as a philanthropic society. Regarding tramway employees, we in Plymouth confine free riding to men going to and from work, and I think that a reasonable thing to do. This small concession of riding free makes the employees take greater interest and feel more settled and contented in their work. As to free riding when off duty, that is the fault of the tramway committees and managers concerned; it should be strictly confined to employees going to and from work. Police constables and special constables, in my judgment, should not be allowed free riding. My friend complains of tramway undertakings supporting the wives of men serving with the colours. Tramway undertakings have not been penalised, *pro rata*, more than gas, water, and electricity undertakings. He also infers that exceptions have been made. Surely, the men working in other departments are subject to the same military conditions and regulations as men working on tramways. Mr. Murray says, the public and some town councillors seem to forget that travelling facilities cost money. I admit that there are some who are wishful to carry some classes at a cheaper rate than they ought to be carried. That I am opposed to. Why should a tramway undertaking be called upon to work at a loss any more than electricity undertakings should be called upon to serve certain sections of the community at a loss, or any more than water and gas undertakings should be called upon to supply water and gas to certain sections of the community at a loss? As to getting the Tramways Act of 1870 remodelled and brought into harmony with present conditions I perfectly agree, and trust the Association will support the idea of pressing on their Parliamentary representatives the necessity of annulling or amending this particular Act. (Applause.)

Alderman BROADLEY (Halifax Tramways Committee).—On the Halifax tramways we date our success financially from the introduction of workmen's fares. I cannot understand people with our experience objecting to carrying workmen at reduced fares. Our ordinary seating capacity per car is 60. We carry anything from 60 to 100 on workmen's cars, and if I had my way, they would be carried free. You cannot always have an adequate supply of cars in the early hours of the morning, and on that account discomfort has to be given to this class of riders. Of course we are told the workmen travelling at 8 o'clock in the morning should have the same privilege, and the school teacher says he should have the same privilege at 9 o'clock. If that was followed out, we should have workmen's fares all the day through. You have only to take railway experience, when every railway company thought it worth while to make handsome profits by running special trains. If you load your vehicle full you can reduce your carrying rates, whether for merchandise or passengers. Our experience has been that the reduced fares for workmen have been an unqualified financial success.

Mr. W. J. MCCOMBE (manager, Hull Corporation Tramways).—In connection with his paper I am inclined to blame Mr. Murray for not having properly laid down his principle, and I see he has been rather troubled by misconception as to the theory of tramway fares. The theory of fares is a theory of averages, and that is just what we are inclined to forget. Mr. Murray lays it down in the paper that the true basis for the fixing of tramway fares is that each passenger shall pay the cost of carrying him. That is just the sort of thing that you cannot assess, because the cost of carrying a passenger changes with the time of day at which you carry him. In the morning it costs you very much less to carry a passenger than it does at other times of the day, and between ten and twelve o'clock in the forenoon it is very much more expensive to carry a passenger than at any other time of the day. If Mr. Murray's theory is correct, I submit that it is the passengers between ten and twelve o'clock that ought to pay an enhanced rate. Mr. Murray also finds fault with some municipalities because they charge less than the statutory fare for workmen. May I suggest that that is the business of the particular municipality concerned? We cannot dictate to any individual system at what fare they shall carry workmen. If it suits them and pays them on the theory of averages to carry workmen at less than the statutory rate, that is their business. In Hull we have a very special rate, which is fairly well known: we carry a workman in the morning for ½d. as far as the car goes, which distance is up to 2⅞ miles. We also carry the ordinary passenger at the same rate as the workman, and we have done that for the past nine or ten years. In that way we do not place the workman on a pedestal apart from the ordinary passenger; whatever advantage is going before nine o'clock in the morning is available for the ordinary passenger as well as for the workman. Those who, like our good President, place the workman on a pedestal, and insist upon the ordinary passenger, who is not a workman—even though he gets up at five o'clock in the morning—paying an enhanced rate, take a great responsibility on themselves. Talk about the "bad old days,"; the bad old people who made the bad old days have not all died off yet. (Laughter.)

With regard to ½d. fares, I am one of those unrepentant individuals

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who believe in them. I have believed in them for years; and instead of becoming repentant I am becoming more fixed in my feeling that they are justified within certain limits, but every municipality must decide the question for itself. They suit Hull; Hull believes in them. There is not a member of the Hull Town Council who does not thoroughly believe in them. But because they suit Hull, the Hull men do not suggest that they will suit Walthamstow or Burnley. Let Walthamstow and Burnley suit themselves. Mr. Murray has fallen foul, in the last paragraph of his otherwise excellent paper, of the Association, and especially of the executive of the Association. He considers that they have not dealt in former years—and possibly he means the present year—with practical everyday questions. I make bold to say that this Association has been signally successful in dealing with practical questions of everyday utility in connection with their annual meetings. At the same time I must say I am very glad that the Association and the committee have not limited their energies to the discussion of what one might call everyday practical questions. We must have ideas as well as practice; and it is one of the virtues of this Association that they deal in ideas, and that they have some imagination—that they look forward to the future and to what the future may bring for them. I submit that Mr. Murray is very wrong in blaming them for the prescience and imagination which they display; but although I find fault with the paper I wish to thank Mr. Murray for it.

Mr. W. Clough (general manager, Bury Corporation Tramways).—I quite agree with the author that, from a business point of view, no passenger should be carried at less than cost price; but we must not overlook the fact that the municipalisation of tramways was not solely advocated as a matter of finance, and from a municipal point of view there may be good reasons why the working classes should be carried at a lower fare than ordinary passengers and yet not be carried *at less than cost price*. If, by offering a lower scale of fares to the working classes (in the words of the author) "we can assist them to a better and brighter environment of their home life and improve the conditions and the upbringing of the rising generation," this, to my mind, justifies differentiation in fares, within certain limits, and to the municipality it will prove a good investment. The author gives an instance in London of 19 miles for 2d., and when he replies I should like him to tell us whether he has found many passengers who want to travel 19 miles night and morning in a tramcar. (Laughter.) The time, at any rate, makes it impracticable. Before he dismisses the use of workpeople's return tickets, I suggest that he should look again into this question. Personally, I have had them in use for many years, and I prefer 1d. return tickets to ½d. fares. The author asks a question as to war allowances. He asks why should the tramway undertakings pay ten times more than the other departments? Mr. Murray would like you to be consistent. Throughout this paper it has been laid down as a principle that there should be no preferential treatment; that each passenger should meet his own obligation; yet here you suggest that the tramways should run away from their obligation. If the tramways do not pay these war allowances to the ment at the front, who is going to pay them? The employment of these men has formed a part of the tramway undertaking, and now this obligation, which the author describes as "right and proper," is laid on the employers, surely it is equally right and proper that the tramway undertaking should meet the obligations; surely, after laying it down that tramways should be carried on on business lines, he is not going to ask the ratepayers to subsidise the undertaking. If there had been no tramways there would have been no war allowances to be paid.

The author also says that we are accustomed to hear it stated that ½d. fares never pay. I am not one of those who would make such a statement; I think we should be prepared to accept the hypothetical case that, given a sufficient number of them and an all-day spread-over, ½d. fares are capable of yielding a handsome return. But these conditions are only to be found in most exceptional and perhaps imaginary cases, and it is no use—even in Blackpool—building castles in the air.

As regards the high level bridge at Newcastle, I do not think the author has told us the whole circumstances. When you wish to cross the bridge you have the choice either of paying ½d. to ride in the conveyance or of paying ½d. toll and walking. As a matter of fact, this is one of those cases where it is as cheap to ride as to walk; consequently the conveyances are well patronised. At the same time only a quarter of a mile is given for the ½d., so that the conveyance charges at the rate of 2d. a mile. Then I should like to say a word on this formula. (Laughter.) Walthamstow seems to be going in for this kind of thing. (Renewed Laughter.) I find no fault with the arithmetic, but I do not understand why a simple division sum has got to be called a formula. Let us see how he applies the figures. He obtains the cost per passenger per car-mile from the formula: there is only one way to do it. But before he can draw any conclusion from it, he must first ascertain how many passengers he is carrying per car-mile. For instance, he must know how many passengers he is carrying at workpeople's fares before he can say they are not paying for their ride. He gives the cost of operation at ·95d., and he assumes that the difference between the ½d. fare for the workpeople makes a loss of practically another ½d. But in this he is assuming that the workpeople's cars only carry an average number of passengers, whereas, certainly in Lancashire, far more than the average number of passengers are carried on the workpeople's cars. There is one figure which he will require to correct—the error may have arisen from the use of the formula; 200,000 car-miles at ½d. do not give a loss of £3,750. The loss I think which he intended to say was a loss of ½d. per passenger per car-mile. From that I should draw this conclusion: do not use the formula. (Laughter.)

Mr. A. Ellis (engineer and manager, Cardiff).—Local conditions must of course control a matter of this sort. We have heard from a number of gentlemen that the workman's traffic is a huge success; in one case I think the finances of the department are absolutely controlled by the workman's traffic. In our case workmen's traffic produces a monetary loss. We carry a workman any distance for 1d., and the maximum distance is from 4 to 4½ miles. The whole of the Cardiff industries are centred at the docks. We carry very much over the carrying capacity of the cars; but notwithstanding that fact, you can imagine a car going four miles and having receipts of three or four shillings, and then going back empty: that is our experience. In the case of Hull, they carry the people back in the evening.

A Member.—Not at the same fare.

Mr. Ellis.—We do. We carry them back in the evening at the same rate, with the result that between five and six o'clock, when the ordinary people are anxious to get home, we have to put aside at least 33 cars to carry workmen at reduced rates. While they are paying 1d. to go four miles, people willing to pay 2½d. over the same distance have to walk.

Mr. Bishop (Walthamstow).—I do not consider the ½d. fare alluded to by Mr. McCombe a workman's fare at all. As to formulas, I do not like Mr. Murray's formula; it is of no use. He saddles his workmen's cars with the cost of running the whole of his cars during the slack portion of the day. Our cars are practically empty from ten in the morning till five in the evening; he saddles his workmen's cars—in which he carries at least 75 per cent. more than he ought to do—with the cost of running those empty cars in the middle of the day. If he will take the workmen's cars alone, and allow for the cost of running the empty workmen's cars back, he will find there is not a loss of £3,000, or anything like it, but that workmen's fares do pay.

Mr. Peter Fisher (general manager, Dundee Corporation Tramways).—In listening to this discussion, supposing I did not know anything about tramways, I must have come to the conclusion that the proper way to make tramways a financial success is to adopt workmen's fares. But, as I do know a little about tramways, that deduction, I feel, would have been out of harmony. In connection with another paper, it was stated that the more fares were reduced the more successful the result. In the small undertaking with which I have been connected for 30 years we have no differentiation of workmen's fares. We have ½d. fares everywhere, and the maximum fare is 1d. The gradients are severe and the expenses are high. There is a great deal in what has been said about cheap fares; there should be no differentiation, but all the fares should be so low as to be workmen's fares. Our undertaking is a gigantic success from the financial point of view; and I think that if, instead of differentiating, you tried having workmen's fares all the day, your finances would improve.

Mr. W. J. Squires (member of the London County Council).—I want to impress on the conference that you must suit circumstances to your conditions and your places. I am going to endorse something I have heard to-day, namely, that I hope we shall not go back to halfpenny fares—(hear, hear)—because I want to use the argument that I do not think it will do in London again. We are not going back to the same conditions which we had prior to the war. It has been a very great pleasure to me to take part in one of the most strenuous discussions in the London County Council on tramway management and fares that ever we had. A special sub-committee was sitting for many days. I had the pleasure of being the chairman of that sub-committee, and I am prepared to say that whatever may happen to the tramways and tramway fares the halfpenny fare has gone, and I hope it will not come back. (Hear, hear.) With regard to workmen's fares, I think one will have to admit that the Government have put on you certain conditions, and I do not suppose the tramway undertakings from choice would have adopted workmen's fares at all, but the Government have laid down that you must take these workmen at certain hours at certain fares, and the London County Council have always been urged very strongly, especially by the Housing Committee, that they were bound to carry the workmen at a low rate, because they had from time to time imposed on the railway companies the necessity to do the very same thing. Our losses on workmen's fares are very heavy indeed. It has been said in the paper that we take a workman 19 miles twice a day for 2d., but 19 miles is the distance out and home. It is not done twice a day. The workman is taken from any of the London bridges to Catford, which is just over nine miles out, and brought back again for a twopenny return fare. In my particular district we have a long route for workmen, and I suppose there is no line of route in this country that is carrying so many workmen as the one which runs from London to Abbey Wood. If you could only see the rush of men, women, boys, and girls in Beresford Square, Woolwich, in connection with the Arsenal. That distance is fourteen and a

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half miles. When we discussed that distance my opportunity came to say this, "Make that route into two distinct journeys," and the Council has done so. That is now a route of fourteen miles reutrn for which the workman, if he travels the whole distance, has to pay 4d. I wish to express to-day how much I feel that you must suit fares and conditions to localities. I have felt it myself over and over again. I want to bear testimony to the excellent work which this Association has done in the past, and which I believe it will do in the future. To-day we have little rumours that you did not take up certain things. It is a time when we all feel there is one thing we must do, and it is possible many other things are going a little on one side if we are to accomplish that great object which we have in view, which I hope will soon terminate in complete victory for England and her Allies. (Applause.)

Mr. MURRAY, in replying to the discussion, said :—In preparing these notes I laid myself out for criticism. Indeed I courted it and I have got it, but I can assure you that I have enjoyed it. I would not have minded a bit if you had gone on for another hour. I was pleased that Councillor Moon has agreed with me in most of the leading points in my notes. I do not think he has seriously criticised any of them, and there is nothing he has said which calls for reply. Then I come to Alderman Broadley. He told us that Halifax scores a big success on workmen's fares. I do not know what the conditions are in Halifax, but as some of the speakers have said of their own districts, we in Walthamstow have to run the outward journey every time practically empty. The traffic in the morning is all inwards. In the evening it is all outwards, and in these conditions we find it impossible to make workmen's fares pay. So much is this the case, that when the Council revised the ordinary fares, they increased the workmen's fares by 50 per cent., and I feel that even now, while the traffic is one with which we are compelled to cope, it is not one which we would ask for if we could avoid it. Alderman Broadley says the railways make a handsome profit out of the workmen's traffic. I would like to know whether that is just the impression he has or whether he can say it is so, because in Walthamstow we had to compel the railway company to provide workmen's fares and cheap trains. In general, I think the railway company favours this class of traffic just as little as tramway managers do. I do not know whether Alderman Broadley's manager agrees with him. Conditions may be different from ours, and I am not in a position to say much about it. With us at all events, workmen's fares have never paid till recently, and it is a moot point now. I come to Mr. McCombe's criticism. He says I have not adopted the true basis in calculating the costs and that the workmen's morning cars cost less to operate than the cars during the day. That is not my experience. My experience is that the workmen's cars, under the conditions in Walthamstow, cost more than the mid-day cars. Mr. Clough very kindly did not criticise my paper seriously, but in regard to war allowances he did not see any reason why tramways should not bear the burden. Take a case in point. My tramway has sent an enormous number of men, relatively to its total staff, to the fighting forces, and we are bearing a burden in connection with dependents' allowances which we can ill afford, unless we are going to become a burden on the rates. Take another department of the Council which sends only five or six men to the national service, while we send about 115. It seems to be unequal that because tramways are able to give these men, another department escapes altogether. I think the burden should be distributed, and if it is right, as I agree, that these dependents should be paid, I think the town ought to pay them and not the department. Mr. Clough spoke about the high-level bridge at Newcastle. His statement is correct, but my argument is that here is a case of halfpenny fares which can be made to pay, provided you get plenty of them and get them all day long. It is quite true that people, if they walk across the bridge, have to pay a halfpenny. With regard to this formula, when I put it down I hesitated, because I knew it would be the subject of criticism. I set it out because the result rather surprised myself and I wanted to make clear to the members of this Association the line of reasoning which I followed in coming to that. I would not be surprised if some member had found fault with the arithmetic, but fortunately it is sound and I do not need to defend it. I am only following the rule of averages and want to get to a safe basis. If there is a margin it is on the right side. Mr. Ellis spoke as to local conditions, and I agree with him through and through. Coming to Councillor Bishop, this is a case of "save me from my friends." He has criticised my comments on workmen's traffic because I have saddled the service with the slack mid-day traffic. I think he is forgetting that the slack mid-day traffic is paying double the rates which the workmen's traffic pays. Overloading such as we have on workmen's cars is not a desirable thing, and in some cases it is physically impossible to collect the fares. I am sure many of us would prefer reasonable mid-day traffic, rather than to have this mad rush which destroys the rolling stock, leads to missing fares, encourages workmen to avoid payment, and gets the conductors into trouble. Another thing against this traffic is that we get the return rush at the busiest time in the evening, and the workmen are being carried at cheap fares at a time when it takes us all we can do to carry the more profitable traffic. All round I am satisfied that workmen's fares are not much use. Mr. Fisher commented on the theory of reduced fares winning success. I do not think that will commend itself to many managers. Because of the change made more than 12 months ago in our fares, including the abolition of halfpenny fares except for children and increasing workmen's fares 50 per cent., our average traffic receipts have risen fully 2d. per car-mile. Instead of having a surplus of £800 last year, we had a surplus of considerably over £6,000. The question is whether municipal tramways should be expected to pay their way or not. I anticipated more trouble than I have met with in connection with this paper, and I thank you for the patience with which you have borne my effort. (Applause.)

A hearty vote of thanks was awarded to Mr. Murray.

The PRESIDENT.—The remaining subject for discussion is one of great importance, namely, the development of tramways. I call upon Mr. Ellis.

## DEVELOPMENT OF TRAMWAYS.

By Mr. Arthur Ellis, M.I.Mech.E.

(*City Electrical Engineer and Tramways Manager, Cardiff*).

In complying with the wishes of the Executive Council to open the discussion on this important subject, I feel that I am taking upon myself a certain amount of responsibility, but if as a result free discussion and expression of views of as many as possible attending this meeting is effected, then some good should result to the benefit of tramways generally and the nation at large.

In opening up a subject of this kind, one ought to be a sort of prophet, as so many things are likely to occur after this lamentable war has been brought to a satisfactory conclusion that cannot at the moment be foreseen. There will be many matters that will necessitate serious consideration, and in my opinion the development of tramways is one of the most important, affecting as it does the welfare of the people at large, both in regard to transport facilities and the development of outlying districts effecting increased rateable values, etc. I would therefore offer the following observations for the consideration of the members of the Municipal Tramways Association. In great cities, as street transport becomes more and more heavy, relief will have to be sought beneath the surface to secure much more rapid transit for the longer distance town passengers, which would mean that the surface tramways would be pushed further out beyond the suburban areas into the country, to help forward developments that must come as part of the scheme of freeing our country from the menace of shortage of food, which we have experienced and are experiencing at the present time.

Tramways or light railways have a great part to play in this most serious of all factors, and whatever is done will have to be done by public money, which will mean some sort of public control, both as to construction and working.

After the war, with the railways suffering as a result of depletion of their engines and rolling stock engaged in the clearing up of the effects of the war and the rebuilding of France and Belgium, great openings for tramway undertakings must arise, and it is probable that we shall not see a return of the larger railways catering for short-distance passengers for a long time to come. This, I think, is indicated by the Government taking over the canals and improving these waterways for electric and steam haulage. In fact, taking advantage of every means of coping with the pressure that must arise, the railways thus being freed to deal with the trunk line (passenger and heavier goods and mineral) traffic, leaving to the tramways and converted canals the passenger traffic in and about our cities, and also inter-urban and city traffic up to 15 and 20 miles.

### Food Cultivation.

We became accustomed to seeing long queues in our cities and towns waiting outside certain shops in order to secure limited supplies of a food that is necessary to the working classes and others in the country. The importance of the potato, which possibly was the cheapest known vegetable prior to the war, and in consequence neglected until it became scarce, was clearly indicated, and in order that there should be no recurrence of this sort people, both rich and poor, had brought home to them the importance of allotments, and I think most of us have seen the potato growing in almost every conceivable place, including what were previously beautiful lawns and gardens, devoted either to pleasure or the cultivation of flowers, and the great rush of people to the allotments has made it clear that the Briton has not lost his love of the land, and the continental idea that he is absorbed in business only has been largely contradicted by the rush to make good our shortage of food. These allotments, near to the cities as they are at the present time, will in due course be required for building purposes, and other provision must be made for the now enthusiastic allotment holder, as those who have not previously had the experience, and who have only recently realised the value of the cultivation of their own supplies, are not going to lightly throw it over.

Tramways, or light railway construction, must solve the problem by providing the means of access in the most reasonable space of time, whilst special rolling stock will be necessary for the conveyance of the produce to the local markets or the railway stations and the canal loading stages. Such an arrangement as this would suit the farmer, and be of the greatest possible service to him, and so we

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find that by means of the tramways we should have solved one of the serious problems facing the farmer and the produce merchant. In my opinion, no other form of vehicle can compete on equal terms with the tramcar as regards easy means of travelling, combined with comfort, convenience, etc. They are certainly more comfortable than motor omnibuses, or other forms of road vehicles, whilst the tramcar provides also double the accommodation for shelter against the worst weather, and in some cases, with double-deck cars, as much as four times the accommodation at the same, or less, labour costs. Congestion of traffic has always responded to treatment by adequate tramway facility, and in like ratio it must assist in the development of our breathing spaces in residential districts, factories, and works, which must come if we are to prevent matters slipping back into the hateful conditions prevailing prior to the war.

The people of this country are suffering very acutely at the moment as a result of scarcity of suitable house property, and this will have to be dealt with some time after the war, in consequence of building operations having been suspended for so long a time. The working people of this country, who are better off to-day than ever they were before, and who are likely to continue so, will not remain content by living under the same conditions as those under which they have been accustomed to live. They will want something better, and will begin to look out for suitable accommodation some distance away from their work in order that they might enjoy the benefits of the open-air life during their leisure hours, and the accommodation of our people will have to be a matter for first consideration, and in consequence villages and hamlets will spring up with mushroom-like rapidity in an endeavour to overtake the demand. This will mean that the workers will have a greater distance to travel to get to and from their work. There can be no better means of providing this than by the extension of our tramway systems, and hence we find the lines gradually getting more distant from the centre of the undertakings.

I would give as an illustration the district lying between the city which I represent, viz., Cardiff, and that of the neighbouring town of Newport, consisting of arable and pasture land for the raising of stock. Ten years ago one could hardly contemplate any demand for transport facilities on the high roads, but from time to time there have been applications to the local railway company for the provision of intermediate stations at suitable places, but without any effect. The railway company, instead of reducing their speeds by stops, have regularly and consistently been devoting their attention to the reduction of short-distance stops and speeding up generally, and we find as a result that a company has had to provide the necessary convenience by means of motor vehicles. Whilst these have not been a satisfactory adventure from the passenger point of view, there can be no doubt that they have been a financial success, and that the small fleet of vehicles has been able to provide only a partial accommodation for the demands, whilst at the same time doing considerable damage to road surfaces. Now with miles of splendid land ready for development into steel works, shipbuilding, and factories of all kinds, with railway facilities available, as well as coal and water in abundance, if properly catered for thousands of houses must of necessity be provided between these two towns, which will necessitate provision of tramway facilities that will for a time partake of the nature of urban for some distance from either town, and rural for a short distance, all the time building up the development of the whole, eventually forming a link between the two towns, and carrying a population that in course of time ought to become a teeming one following the great industrial and agricultural development.

This is only one example of many hundreds, if not thousands of others, that must exist at the moment. In my opinion the tramway car ought, and should be, the pioneer in this "after the war development," no other vehicle to my mind being able to give the necessary accommodation at equal cost, and by providing such facilities we shall be performing a duty of national importance. The trunk railways, being freed of short-distance traffic, will be enabled to devote more attention to the conveyance of stores, coal, iron ore, etc., required in the manufacture of things necessary to the rebuilding of the industries of the country, thus making up in some way the shortage of engines, rolling stock, etc., and further, by short spur lines and connections running into the railway yards, and transferring goods brought down by railways to light tramway cars and trailer goods wagons, goods and merchandise, for delivery at short distance in the urban and rural districts, served by the new tramways, and thus we shall be conserving and economising our coal stocks by adding to our electrical haulage facilities, which I think we recognise to-day have not been used in a way nature would have us do.

No argument can entirely demolish those which I have put forward, because I should retort by pointing to the electrification of all lines operating in and around London and other cities, making, as I claim, for convenience generally, together with speed, comfort, cleanliness, and saving of coal. For the passenger rush each morning and evening, what can deal with the problem so easily and cheaply as the tramway trailer car, added to each ordinary car at the necessary time, adding no more to the wear and tear of the roads as motor omnibuses must do, nor adding to the inconvenience of other users of the road, because the trailer car does not race and pass in competition with other cars, but is restricted to its own natural course?

Liverpool has dealt with the matter of goods traffic to some extent, sufficiently to prove its possibilities of development, and other cities are dealing with the goods traffic and mails, and it only remains to decide the form of track and other general equipment of the undertaking to make the town and country tramways both a necessity and an unbounded advantage, because we know that all the new proposals to deal with the new commerce to be handled are, at the same time and principally, for the convenience of the traveller who has to live a distance from the scene of his labours. We know that on holidays and special occasions John Bull and his wife will take pleasure, and nothing is so attractive as a ride through the city and on into the country with its health-giving fresh air, etc., and we have only to quote the increase of motoring between town and town, and local journeys by car, by those whose means permit of such luxuries to realise that at all events it has fed and cultivated the idea of getting to know more of one's country before going abroad.

There is only one point that I should like to touch upon in conclusion, viz., the restrictions under which local authorities and others have to work. If tramways are to be developed, as one would desire, then in my humble opinion it is necessary for some new method to be adopted for affording the necessary means, and the present time costly method of procedure by Act of Parliament should, if not entirely so, at any rate to some extent be modified. Further, that the development of tramways whould be undertaken by local authorities, if not undertaken as a national work. I have no grudge against the company promoters; they have taken their risks in providing the necessary monies for the equipment of undertakings, providing equal facilities; at the same time, however, one cannot neglect the fact that by being undertaken by local authorities they are being so for the benefit entirely and exclusively of the user and for the good of the public at large. This is indicated, I think, at the moment in the suggestion that in due course our railways shall be nationalised.

I feel that I have not done full justice to so important a subject, but no doubt the discussion that will ensue will have the desired result, viz., an expression of the views of a number of gentlemen present as to the best means to adopt for the future development of our tramways after the war in order that a great need shall be provided for the people of the country, and if this is brought about a work of great national importance will have been achieved.

Whilst I am limited as to time by request of the Executive Council, I suggest that the importance of the subject is one upon which many hours of discussion and interchange of opinions might well be spent with great advantage to us all.

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Councillor C. RAINE (vice-chairman, Hull Tramways Committee).—This paper opens up such important points that I would suggest that we postpone till to-morrow the discussion of it. (Hear, hear.) I think we would do far more justice to it.

The PRESIDENT.—I think the discussion should be adjourned on account of the importance of the paper and seeing that the hour to-day is so late. If you are agreed on that, the discussion stands adjourned till to-morrow morning.

This was agreed to, and the Conference adjourned till the following day.

## FRIDAY, SEPTEMBER 21.

The discussion was resumed on the Friday by

Councillor C. RAINE, who said:—I have read and re-read Mr. Ellis's paper, and I consider that it is one of those which does not make for criticism so much as for general discussion. The author has ventured on lines that are sometimes considered to be dangerous. He has ventured very largely to be a prophet. We know that sometimes that is a very dangerous occupation, but I think in view of the great changes on account of the war, Mr. Ellis has been perfectly justified in lifting up the veil of the future and giving us his views as to what probably may be required after this disastrous war has finished. He has touched on so many subjects of interest that I think it will be quite in the provinces of this conference to look into what he has revealed of the future more than we are doing at the present time. We are all agreed that great changes in every phase of life will be likely to take place, and in no private and public work will changes be more likely to be required than in that of tramway traction. The possibilities that lie before us in regard to the transport of passengers and light goods seem to me to be almost overwhelming, and it is for you who are experts on this matter to be prepared, so that the municipalities may tackle satisfactorily the problems that lie before them. The development of our tramway systems so as to meet the possibilities that will ensue between town and country seem to me to be worthy of the gravest consideration. All towns, more or less, have large outlying urban districts. The great difficulty that I have always seen, and the greater difficulty that I see in the future, is the bringing together of the suburban and the urban so as to be of equal benefit to both. Mr. Ellis very pointedly drew attention to what has

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been done between Cardiff and Newport, and what has been done there ought to have been done, and probably will have to be done, very largely in other areas. In Hull we are peculiarly situated. Some people say that we are isolated and that as a small village on the Humber we stand exclusively by ourselves. But some of us think we are rather an important town or city on the east coast, but, as I say, geographically we are peculiarly situated. Running east and west at the mouth of the Humber, Hull cannot develop on that side, but on the east side, running from south to north, we have thousands of acres of land cultivated in various ways. It is land which cannot, or has not up to the present been attainable by our railway systems. Mr. Ellis's paper has pointed out to me a very large and important vista as to the possibilities in regard to Hull. As I say, we have huge areas of land which are outside of the possibilities of the ordinary railway system. The value of that land and the produce of it is very largely minimised by the difficulties of the farmer in getting his produce to the city. Mr. Ellis hints in his paper at the possibility of tapping these outlying districts by tramways. That is a point that I think should be seriously considered by tramway managers and their committees. In my opinion, regarding our own district, the great possibilities of bringing into the town the inhabitants of these outlying villages and districts and their produce and taking back with them things they require in their homes will, if fulfilled, be a great advantage.

Of course I know that a good deal of the matter in Mr. Ellis's paper is wrapped up with the housing problem and the desire of our workers in the large cities to live a brighter, a better, and a freer life. The catering for our outlying urban districts will very largely solve the difficulties that we who take an interest in the sanitary conditions of our cities feel. The next point I want to touch upon is one that, up to the present, has not been considered. Take your ordinary city. In nearly all cities, probably, we have large congested areas lying outside our main thoroughfares. In Hull, the Housing Committee have had this problem before them from time to time. One part of the city, where scores of thousands of people are gathered together, is outside of the benefits of our tramway system. I would like to see, and I would like to hear from gentlemen present, that there is a possibility of having a light trackless vehicle system that could be utilised on the ordinary roads lying away from the main thoroughfares. We have in this district a large population, with no possibility of laying down ordinary tramway tracks, and it seems to me that these people deserve as much consideration in regard to facilities for travelling as some of us who have the privilege of living on the main roads. Apart altogether from the question of financial benefit to a municipality, we ought to consider it from the point of view that these peoplo have the same right to consideration as others. If any hint can be given at this conference as to the possibility of development in that way by trackless car or other means of locomotion suitable for ordinary or narrow roads, I think some good will have resulted. One can scarcely wonder at the discontent freely expressed in our larger cities when we remember the points I have just brought before you. People are unable to get either to their work or to the centre of the city or to the numerous parks and recreation grounds, because they happen to live away from the main thoroughfares.

Another point, and a very important one, which Mr. Ellis has touched on, has been the outcome entirely of this calamitous war, and that is the growth of the system of allotment holders. These men and women having once experienced the benefit of growing their own vegetables will not abandon the pursuit. I know, also, how the cultivation of flowers not only benefits but raises the whole tone of the man and his wife and his children, and I am one of those who whole-heartedly support the scheme of allotment gardening. Mr. Ellis hints in his paper that these people will not be content to go back to their usual humdrum life, and to have to purchase, through a middleman at exorbitant prices, their vegetables and sometimes their flowers for beautifying their homes, but that they will have a desire to produce these things themselves. That means, if we intend to carry out this allotment scheme in its larger outlook, that we must be prepared to carry our inhabitants further out from the city and provide for their recreation there, without having to put them to the inconvenience of walking, as many of them have to do, or paying fares which are large to them, to get to and from their allotment gardens. Following on that idea, sooner or later, not only will these allotment plots, which are largely within city areas, come within housing and town planning schemes, but I hope that many of the congested areas also will come under such schemes, so that the existing houses in the congested areas may be demolished and, I hope, replaced by factories, workshops, and mills. As one who has taken an interest in health and housing matters, I am looking forward to the use of these allotment gardens and houses for a higher and better and bigger purpose in life than what has hitherto been hoped for.

I know what the difficulties of all municipalities have always been whenever we have approached our suburban neighbours. We generally meet with strong opposition, and very naturally perhaps from their point of view. We have surrounding a city small villages with urban district councils, etc., who live, or try to live, a very exclusive life—I suppose I might say a superior kind of life to that of the town dweller—and they naturally resent any attempt to bring their village or little town within the purview of our cities. But my point with them has always been this, that while they are willing to use all the facilities of a town or city, to get all the benefits of a tramway system and their water and gas supplies, in many cases they are not willing to contribute towards the upkeep of these benefits and facilities which the town provides. But they cannot have it both ways. If a village outside a city desires pure water, and to have gas and other facilities, surely it is right that we should ask these people to contribute in some small measure to the cost of those benefits. But the difficulty has been that we have to go to Parliament to ask a number of gentlemen to give us the power to rope in these villages, and we have to deal with gentlemen who do not know the local requirements. Mr. Ellis has touched on a very important point when he suggests that that power should be relaxed to a sufficient extent to allow local authorities to be the best judges as to what local authorities require. If this is done, I venture to prophesy that very shortly great improvements will be made, not only to the cities but to the surrounding villages which will be drawn within their area. I have no hesitation in saying, as I happen to live just outside the borough of Hull and escape the rates of Hull for my residence, that I would rather pay the higher rates and get the benefits of the police, water, gas, and electricity of Hull, than I would pay the rates of the village in which I happen to reside. If men could be brought to see it in that light, they would prefer to pay for the facilities we could given them. I am very much obliged to Mr. Ellis for his excellent paper.

Mr. A. R. Fearnley (general manager, Sheffield Corporation Tramways).—There are two matters arising to which I should like to refer. Mr. Raine suggests that we should connect up the rural districts by some sort of trackless trolley car or other vehicle. I would suggest to Mr. Ellis and Mr. Raine that they are holding the motor omnibus much too lightly. Mr. Ellis only refers to it on two occasions, and seems to think that it is scarcely worth serious consideration. My experience is totally contrary on this matter. For some four and a half years we have been largely developing the rural traffic round Sheffield by the aid of the motor omnibuses. We have found them most satisfactory vehicles for the purpose, and we have built up a traffic of six and a half million passengers per annum and receipts of £40,000. In addition to that, the motor omnibus is assisting very largely in the development of our tramway system. The majority of the passengers become long-distance tramway passengers and come into the centre of the city. So from every point of view the motor omnibus is worthy of more serious consideration than he has given to it.

The other matter is the development of the existing tramways. I have taken some figures out from a return of information supplied by members in response to a request, a return showing the number of rides taken per head of the population for the last financial year. The following are the figures which I have received :—

Comparative Statement showing the Average Number of Rides taken per Head of Population for the last Financial Year in the undermentioned Towns.

| Town | Rides | Town | Rides |
|---|---|---|---|
| Glasgow ... ... | 338 | Newport ... ... | 124 |
| Sheffield ... ... | 301 | Birkenhead ... ... | 124 |
| Blackpool ... ... | 290 | Portsmouth ... ... | 123 |
| Newcastle ... ... | 260 | Dundee ... ... | 121 |
| Manchester ... ... | 223 | Halifax ... ... | 120 |
| Rotherham ... ... | 209 | Ilford U.D.C. ... ... | 120 |
| Bradford ... ... | 208 | Southend ... ... | 118 |
| Leeds ... ... ... | 207 | Rochdale ... ... | 116 |
| Hull ... ... ... | 204 | Preston ... ... | 115 |
| Liverpool ... ... | 203 | Derby ... ... ... | 113 |
| Birmingham ... ... | 197 | Stalybridge ... ... | 112 |
| Ashton-u-Lyne ... | 196 | Wolverhampton ... | 110 |
| Cardiff ... ... | 183 | York ... ... ... | 110 |
| Huddersfield ... ... | 181 | South Shields... ... | 109 |
| Leicester ... ... | 181 | Croydon ... ... | 105 |
| Belfast ... ... | 178 | Brighton ... ... | 102 |
| Nottingham ... ... | 173 | Coventry ... ... | 102 |
| Aberdeen ... ... | 173 | Burnley ... ... | 98 |
| Leyton ... ... | 168 | Colne ... ... ... | 97 |
| Salford ... ... | 168 | Stockport ... ... | 97 |
| Wallasey ... ... | 168 | Leith ... ... ... | 95 |
| West Ham ... ... | 164 | Walthamstow... ... | 95 |
| Northampton ... | 160 | Ipswich ... ... | 84 |
| Southport ... ... | 160 | Chester ... ... | 84 |
| Bexley Heath... ... | 151 | Walsall ... ... | 83 |
| Bournemouth... ... | 149 | Warrington ... ... | 83 |
| Erith ... ... ... | 148 | Wigan ... ... | 81 |
| Reading ... ... | 143 | Gloucester ... ... | 69 |
| East Ham ... ... | 141 | Darlington ... ... | 68 |
| London C.C. ... ... | 140 | Exeter ... ... | 68 |
| Ayr ... ... ... | 139 | Burton-on-Trent ... | 65 |
| Oldham ... ... | 137 | Chesterfield ... ... | 63 |
| Bury ... ... ... | 130 | Blackburn ... ... | 59 |
| Sunderland ... ... | 127 | Lowestoft ... ... | 52 |

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It is curious to note that there are only some ten towns in which the people are taking over 200 rides per head per annum. There are 41 towns between 200 and 100, and 17 below 100 rides per annum. That suggests to me that there is a good deal to be done on the existing tramways in the way of developing the riding habit. One way is connecting up with other tramways. Through running is responsible for a very large increase in traffic, and in the number of rides taken per annum by the population. If you look at the list you will find amongst the towns with over 200 rides per head of the population per annum some small towns, and I attribute that to the connection or through running which they have with other tramways.

Mr. N. J. Young (general manager, Newport Corporation Tramways).—The time is ripe in my opinion for a general recognition of the fact that the interests of towns and localities lie in housing, town planning and tramways combined. Tramways should be laid out for improvements on garden city lines where land can be purchased at low rates, and if necessary compulsorily, if owners want unreasonable figures. As tramways laid with the prospect of housing would result in a loss for a time, some step should be taken to overcome this. The loss in prospect would be sufficient to deter the tramway manager from recommending the extension. I should say national assistance should be available. Why not divide Great Britain into districts, working under a Government department? It should be our business to obtain a grant or to make grants in desirable cases where housing is the main object. It seems to me that our Association might be moving for such a purpose. I daresay there will be a great deal of work, but even the paid services of a whole-time Secretary would not be insurmountable of attainment. If that were done, I think the expenditure would be well repaid.

Alderman W. C. Fenton (vice-chairman, Sheffield Tramways Committee).—I think the illustrations which Mr. Ellis has given us with regard to the development of tramways in the direction of Newport is very apposite, because it is not merely a local illustration, but one which will apply equally well to scores of places in the United Kingdom. (Hear, hear.) I do not know whether Mr. Ellis had at the back of his mind the thought of the interesting traffic I have observed on that road on a Sunday evening, but in any case it is a very good illustration of tramway development. With regard to the mass of the proposals which he has foreshadowed, I think most of us are in perfect agreement, but there is one suggestion to which I should take the strongest possible objection, and that is that these developments might be undertaken nationally. Whatever may be said in favour of the nationalisation of railways—and I am rather of the opinion, after the experience we have had lately, there will not be quite as much to be said in favour of that as in the past—I think so far as municipal tramways are concerned, even when linked up with others, they are all of a local character and should be dealt with by the local authorities concerned. We have also to look in the face the fact very ably put before us by Alderman Spencer yesterday, that the principal difficulty with which we shall have to contend will be the great difficulty of finance. Mr. Spencer drew a rather gloomy, but I am afraid a correct, view of what is going to happen in the near future. It is all very well for us to talk about extensions of tramways, but we have this one great difficulty to contend with, and I am afraid in that direction we shall require to have national help to enable us to do what is necessary for the benefit of those who live in large cities. That will be so if we are to carry out in anything like their entirety the schemes which Mr. Ellis has foreshadowed to-day. In that case we shall have to be subject to a certain amount of control, but I hope the tramway world generally will very strongly object, and persist in objecting, to any control that interferes with our liberty as to the particular direction in which those extensions shall take place. I think we may get over one of the difficulties mentioned in Mr. Ellis's paper, that is, the difficulty of obtaining sanction for extensions and new systems on account of the cost of Parliamentary Bills. I think probably an outlet in that direction will be found in the suggestion in the new Education Bill for provincial associations or councils. I am hoping that Parliament will provide for some devolution in that respect, which will validate the operation of municipal tramways and other municipal concerns without having the worry and expense of going to Parliament for each extension that may be required. I have always been a strong advocate of a moderate adoption of the American system of laying tramways—that is to say, not to wait for the population to make the tramways, but for the tramways to make the population. (Hear, hear.) It is a somewhat bold scheme, but any man sufficiently far-seeing and knowing his district will agree with me that the tramways are the first prime mover in doing away with the difficulties of slums. If councillors will take up the work in that direction—I have known it to succeed locally, and I am sure it will succeed generally. We ought to go into a bold policy, subject to the financial aspect of making the population by the tramways.

Mr. A. Baker (general manager, Birmingham Corporation Tramways).—In the first place I think the most important point touched upon in Mr. Ellis's excellent paper is this question of Parliamentary control. (Hear, hear.) The restrictions which the tramways have suffered have been simply monstrous. You know the procedure. Your tramway committee decide that they would like to lay a tramway in a certain district. Having come to that decision they get the approval of the City Council. They must then prepare a Bill and apply to Parliament. They must exhibit notices on all their lamp-posts. They must advertise in the daily Press a considerable number of times. They must brief counsel, and finally they must appear before a Parliamentary Committee, mostly motor car owners who have not the slightest sympathy for tramways and know nothing of the district, and one or two interested persons who do not want tramways coming along from other towns. In the result you are probably floored. I say that is a monstrous state of things, and I think some action should be taken to enable tramways, particularly in towns which have their own systems, to be laid when the tramway owners, that is the City Council, say they shall be laid, without any interference from Parliament whatever. Of course I quite understand some Parliamentary control is necessary where you are laying tramways in two or three different areas belonging to different authorities, because there must be a conflict of interests in such cases. But wherever an authority wishes to lay down a tramway and build up its system, some less costly procedure ought to be possible. Some effort ought to be made by this Association to cheapen the cost and to lessen the difficulties in connection with the construction and development of tramways.

Alderman Spencer (chairman, Halifax Tramways Committee).—We find ourselves almost in complete accord with the views expressed by Alderman Fenton, but there is one aspect of the subject which we ought to touch upon, and that is the question of goods carrying. We municipalities have always looked on passenger traffic as our great be-all and end-all, but I believe in the future the tramways are going to be the greatest medium of road traffic for goods carrying that it is possible to have. Let me refer shortly to one incident which has brought it home to my mind. I happen to be chairman of a very large company which takes minerals from a point two miles away from Leeds to a point five miles away from the sources of the minerals. We approached the Leeds tramway department with a view to having this mineral carried. At the beginning of the war we found considerable difficulty in getting cartage and in getting motor vehicles. The Leeds Corporation, looking at this from a purely commercial point of view said, "We think something could be done to help you and help ourselves, thus making the interests mutual." We are now carrying over these tramways, through the help of Leeds Corporation, something like 20,000 tons of material a year. So successful has the experiment become that the Leeds Corporation, in their broadmindedness and their anxiety to help the national interest, are laying down for us from another point of our works a tramway which goes across private property. By the assistance of the Minister of Munitions we have been able to get over the opposition of the railway company and have crossed one of the bridges over the railway. We shall at the end of this year be carrying 50,000 tons of mineral per annum. That is a great advantage to the nation, because we have been able to turn out the very first thing in the production of munitions. That is the linings in connection with open hearths. We have been able to turn out the first element in the production of chemical goods, and you can reckon up what 50,000 tons of that material has been as a national asset. We must travel along the lines of making our tramways goods carriers. Our experience has been not merely a financial success to us, but I believe it is a financial success to the Leeds Corporation. You have not to take it from the standpoint only of how much money the Leeds Corporation is getting out of it. You have to take into account the saving in maintenance of the roads. We had 100 horse carts and motor wagons passing over the roads. We have had nearly 80 carts taken off the roads, and the tramways are now carrying the material. Take the cumulative savings. I venture to say that tramways, as goods carrying agencies on high roads, are to be a great national asset in the future.

One other point was referred to by Mr. Fenton in regard to finance, and was also foreshadowed by the writer of the paper. It seems to me that extension of tramways in the future must be entirely based on the national interest, and if we want to extend a tramway merely to carry people to a certain point, unless it is in the national interest to do so we shall not be allowed to do it. We have a form of Treasury control which is exercising a very wise and judicious influence. I believe that control will continue. In France and Germany they have had a similar control for many years. I believe it is going to remain in this country. But do not forget the immense amount of work lying dormant. Look at the great water, sewage, and other schemes. These will involve expenditure by municipalities of a great deal of capital. I think the capital for the extension of municipal tramways will have to come through the Government or out of the reserves of the municipal undertakings. If it comes through the Government it will bring about a form of control. As to Parliamentary procedure, that, I think, we are all agreed is a little too technical and elaborate. What we want is some county form of administration—a form of devolution whereby county boards for tramway or other purposes will appreciate what is necessary in the particular district. A great deal of the expense of Parliamentary promotion can be done away with. What we want is local self-government, with a knowledge of local considerations and difficulties. When we get that we shall be able to forge ahead. As to railways, I believe the great extension of them will be in the shape

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of electric railways. Anyone who has studied the American system knows what a great asset and saving it is, first on account of the low cost of operation, second the national saving of coal, and third the general advantages to be derived from widespread electrification. I think in tramway undertakings we ought to try to save everything possible. In saving let us build up our reserve funds and let us provide for local interests out of reserves by imposing proper and adequate fares.

Mr. A. H. Scott (Highways Committee, London County Council).—My municipal and my tramway soul is in my native city. We in London can neither carry our tramways where we want to carry them, nor when we do get the tramways can we bring the people to the places they want to arrive at. But there are more advanced municipalities than that of London, and it is to them that I wish to speak. I quite agree with Alderman Spencer. We have to turn our tramway undertakings more into the nature of lines for the conveyance of goods, and it is on this special point that I want to speak to the representatives of the tramway undertakings of enterprising municipalities. These municipalities own their markets. The conveyance of agricultural produce to the market is one of the greatest taxes on the food of the people. (Hear, hear.) I can see a tramway undertaking utilising its rails and freight cars; the freight cars could be uncoupled at the Corporation market, and by their use not only would there be a saving in the road maintenance, but a saving of enormous expenditure on the cost of the food in that particular locality. When I went to America first, years ago, to inquire into this question, they told me that if you start a tramway in the prairie and get a long distance line, that will be the most profitable. In all the inquiries I have made in this country since, I have always found that the biggest return is on the longest journey. Therefore I think if we can show in these agricultural districts that we do not only consider the needs of the towns, but also wish to benefit the agricultural districts to which we want to have access, a great deal of our difficulty will be removed. (Applause.)

The President.—I think the time is so short that we cannot afford to spend more on this paper, but Mr. Ellis will probably want to say a word in reply. I would just make a remark on a suggestion in his paper. He speaks of the relief of congestion for through cars in large cities. He thinks that the delay in the centre of a city is insuperable without tunnels or some such relief. Recently Manchester has been inquiring into that question, and I believe they have come to the conclusion that tunnels are out of the question on account of their cost. I wish to make this suggestion. I think there should be a provision of shunting loops with automatic points to allow through cars to pass the shuttle cars. There is one reference at the end of the paper which ought to be deleted. The author makes an apology for putting forward his suggestions. I never read a paper more fruitful. (Applause.) Therefore I think we should delete the apology from the paper.

Mr. Ellis, in reply, said:—I appreciate very fully the kindly remarks which have been made. I anticipated, of course, that I should be very badly slated. One realises that in being asked to open a discussion, the discussion is generally limited. If I had been asked to read a paper on the subject I possibly would have refused, because it is a subject on which one could talk for hours, if not days. Councillor Raine spoke of the value of the land cultivated. Of course, that is accepted by everybody, and that value is going to be continued in the future after the war. He mentioned the question of trackless trolley cars for districts lying behind our main arteries. That is a matter for the consideration of the local authorities. There is no reason why they should not be developed if considered necessary. He touched on the question of the development of city areas for factories and works, and taking the housing outside to be the suburban districts. The opposition of neighbouring councils will have to be got over some way or other. It is handicapping the development of tramways very seriously.

Mr. Fearnley mentioned his experience in Sheffield with motor omnibuses. He is to be congratulated on the large number of passengers he carries and the excellent receipts he is obtaining. Possibly in the near future he may come to the view that it is time to extend his tramways and take his omnibuses further out and continue the development which has been so satisfactory in existing areas. As regards the remarks of Mr. Young, personally I would like to see the exchange of running facilities between Cardiff and Newport, but here is the difficulty. If they wanted to obtain these facilities they would have to go to Parliament, and the powers might be refused. What happens? A local omnibus company comes before a local licensing committee, gets the licences, and the next day the omnibuses are running. Alderman Fenton mentioned the question of Sunday evening traffic at Cardiff. Cardiff is somewhat peculiarly situated. One edge of the city is on the boundary of the county and is also on the boundary of England and Wales. In Wales public houses are closed on Sundays. (Laughter.) By walking along this road about half a mile you can get a drink under the same conditions as in England on Sunday, but there is no desire on the part of the City Council to cater for traffic of that nature. It is not by any means desirable, and we hope that the restrictions now prevailing inside that boundary will continue after the war. The district is more fit to live in than it was before. In regard to difficulties of finance, these will have to be contended with and, we hope, will be surmounted. But what I want to avoid is dual control of the roads. As regards national control, I only suggested it as an alternative to control by municipal authorities, which is desirable from every point of view.

Alderman Spencer has touched on the important question of the development of goods traffic. I am highly interested in what he has told us of his personal experience and of the arrangements with the Leeds Corporation. This opens up rather a fine point, namely, the difficulties of obtaining powers for concessions. What happens now, owing to the war? Mr. Spencer is interested in a factory, Leeds Corporation are interested in their tramways; this factory wants a line laid to get its goods taken away quickly and under improved conditions; they do not have to go before Parliament, they do not have to bring witnesses, and they do not have to incur heavy expenditure. They go to a business man at the Ministry of Munitions, put their proposals before him; he sees the proposals are of a business-like character, and he says "Go ahead." He also obtains wayleaves over railways in districts called "No man's land," which are always the most difficult in which to get wayleaves. What a pity this sort of thing cannot be continued after the war, so that local authorities might go to a business body of men and get what they want. On the question of county boards of control, that would be desirable if it could be developed.

Mr. Scott spoke of the carriage of goods to markets. That is an important matter. As to the extension of tramways into the prairies, we agree; we have had the experience ourselves. We find that if we lay a cable along a road likely to be developed for house property, the people who build the property take a supply of electricity. But if you wait till the houses are built and have gas in them, the people will not afford the expense of taking out the gas and putting in electricity. The same applies to tramways. We ought, if possible, to protect the people against enhanced land values through the development of tramways. (Hear, hear.) That is what represents the greatest obstacle. As soon as there is a suspicion that a municipal authority or a company intends to extend its lines, the individual holding the land, or someone who hears of the proposal and purchases the land, puts up the price until it becomes prohibitive, with the result that the development is not carried out. (Applause.)

A hearty vote of thanks was accorded to Mr. Ellis for his paper.

This closed the conference proceedings.

## MEETING OF MANAGERS.

A meeting of the Managers' Section of the Association was held on Friday, September 21, with Mr. Mozley in the chair, when it was unanimously agreed that the managers' spring meetings should be resumed, and that the next meeting of the kind should be held in Birmingham.

## EXTRAORDINARY MEETING OF THE ASSOCIATION.

### Constitution of Officers.

An extraordinary general meeting of the Association was held subsequently, when a resolution was passed confirming the alterations in the articles of association which had been passed at a general meeting in London on August 31, 1917. The amended articles refer to the constitution of the officers of the Association, the chairman at the meetings of the Association, and the chairman of the Council.

That the following articles be substituted for Articles numbered 21, 25, and 47 of the Articles of Association, that is to say:—

#### Officers.

Art. 21.—The officers of the Association shall be the president, vice-president, chiarman of the Council, honorary solicitor, and secretary or honorary secretary, and treasurer or honorary treasurer, and such others as may be from time to time decided upon after due notice at the annual general meeting of the Association, provided that no person shall fill the position of an officer of the Association unless he shall be a member of the Association, except in the positions of secretary and treasurer, and honorary solicitor, which offices may, if desired by the Association, be held by persons who will not be members of the Association. The first honorary secretary shall be Arthur Robinson Fearnley, general manager of the Sheffield Corporation Tramways.

Art. 25.—The president, on vacating office, shall become an *ex-officio* member of the Council for three years, provided that in the event of the president or vice-president being continued in office for a longer period than one year, as provided by Article 24 the *ex-officio* membership of the Council of the ex-presidents shall be continued for such lengthened period.

#### Chairman of Meetings of the Association.

Art. 47.—The president for the current year, or, failing him, the vice-president for the current year, or, failing him, such member of the Council as the meetings shall appoint, shall take the chair at all general meetings of the Association and shall direct the proceedings. If no member of the Council is present at a general meeting, any member present may be appointed to take the chair. The decisions of the chairman on all questions of order and procedure shall be final.

That the following new clause be added after Article 47:—

#### Chairman of the Council.

Art. 48.—At the first meeting of the Council held after the annual general meeting of the Association the Council shall appoint one of their number to be chairman for one year at all meetings of the Council at which he is present. If the chairman is absent from any meetings the members present shall appoint one of their number to act as chairman in his stead.

That the numbers of the Articles of Association from 48 to the end be raised accordingly.



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## ANNUAL BUSINESS MEETING.

The sixteenth annual general meeting of the Association was held on Friday, September 21, following the extraordinary meeting reported above.

ACCIDENT TO A MEMBER.

The PRESIDENT.—Before we proceed to the business meeting, I have a letter to read. Some of you know that Bailie Buist, of Dundee, met with an unfortunate accident yesterday, and he is unable to be present to-day. I am sure it would be in order for the honorary secretary to convey a message to him from this meeting and a wish for his recovery. He has written to me as follows:—

"Dear Mr. Mozley,—I regret that the accident I met with yesterday prevents my being present at the annual meeting to-day, as I wished very earnestly to impress on the Association that we in Dundee trust that the annual meeting of the Association will be held in Dundee at the earliest possible opportunity after the war. Though the year of Mr. Fisher's presidency has passed, your promise to come to Dundee has not, and we therefore trust that whoever is president when the war ceases will waive his right to have the meeting in his own town, and allow you to come and visit a northern town, pleasant in situation and unsurpassed for tramways. Believe me, yours sincerely,

"WILLIAM H. BUIST."

The PRESIDENT.—The first item is the report of the Executive Council. I have to call your attention to the unfortunate loss which this Association has suffered from the death of Alderman Miles and Alderman Brodie. I need not say anything to you of the admirable qualities of these two grand men, but I ask you to stand up as a mark of respect and honour to their memory.

The members stood up in silence.

The PRESIDENT.—The report of the Executive Council is now before you, and may be discussed.

[The report is given on pages 267 *et seq.*]

Alderman J. BOWES (chairman, Manchester Tramways Committee).—I move that we accept and adopt the report as printed.

Mr. J. F. SIMPSON (engineer and manager, Preston) seconded the motion, and it was carried unanimously.

The statement of accounts was also submitted and agreed to.

Mr. A. R. FEARNLEY.—There are vacancies on the Executive Council for three councillors and two managers. The councillor who retires is Alderman Spencer, and he is eligible for re-election. The managers who retire are Mr. Baker and Mr. McElroy, both of whom are eligible for re-election. The other vacancies are caused by death and promotion to other positions. The councillors to be elected may be aldermen or bailies.

The PRESIDENT.—The first business is to elect the president for the ensuing year, and it is one of the privileges of the chair to make the proposal. Happily we have no difficulty in selecting Alderman S. Flint, J.P., chairman of Leicester Tramways Committee, who has been our vice-chairman for the past year, and who has been of great service on the Executive Council. I have much pleasure in proposing him as president for the ensuing year.

Councillor HEAP (Burnley) seconded the motion, and it was carried unanimously.

Alderman FLINT, in replying, said:—I thank you very sincerely for the honour. I have never sought it; it has been rather thrust upon me. I regret very much the occasion which has opened up the necessity for it, namely, the loss of our friend and colleague, Alderman Miles. He was a man we all admired for his energy and straightforwardness and devotion to the work. I did hesitate in allowing my name to come forward, even as vice-president. I felt I could not fulfil the duties of president, but with such able colleagues as I have I hope to get through with satisfaction to you. I shall do my best (Applause.) I now have the privilege of proposing for the vice-chair during the year Mr. T. B. Goodyer, manager, Croydon. (Applause.) His name is admirably received in every quarter. He is a favourite among us all. Those who have met him for many years on the Executive Committee are perhaps better able to appreciate his ability and character than those who know less of him.

Councillor BISHOP (Walthamstow).—Mr. Goodyer is a favourite with everybody, and as a representative of the south I have the greatest pleasure in seconding the nomination.

The motion was carried unanimously.

Mr. GOODYER.—I thank you very much indeed for the high honour you have conferred on me, and I shall do my very utmost to merit your selection. (Applause.)

The PRESIDENT then called for nominations for the three vacancies for municipal representatives on the Executive Council, and the following were nominated:—Alderman Wood (Stalybridge), Alderman Spencer (Halifax), Councillor R. Mayne (Newcastle), Councillor J. Timpson (Portsmouth), and Alderman Wylie (South Shields). A ballot was taken, with the result that Alderman Wood, Alderman Spencer, and Councillor Mayne were elected. Mr. A. Baker (manager, Birmingham) and Mr. J. M. McElroy (manager, Manchester) were elected as the managerial members on the Executive.

Mr. A. BAKER.—In regard to the treasurership, as you are aware Mr. C. J. Spencer, of Bradford, who has acted as honorary secretary for so many years, and with such conspicuously good results—(hear, hear)—unfortunately has had to retire from the position owing to Government work which he has taken up. Mr. Spencer has rendered magnificent service to this Association, and we feel it would be a very distinct loss if we were to allow him to retire from the Executive. At present he is not a member of the Executive Council, but there is a way by which we shall be able to retain his services and valuable advice. The position of secretary and treasurer is now vested, for the time being, in the hands of one gentleman, Mr. Fearnley. He is quite competent to fill the bill, but we think it is desirable, in order to secure the services of Mr. Spencer, that we should elect him as honorary treasurer, Mr. Fearnley continuing the office of honorary secretary. I accordingly move that Mr. Spencer be appointed honorary treasurer.

Alderman E. PRIESTLEY (Bradford) seconded the motion, and it was unanimously agreed to.

The PRESIDENT.—We now require the services of an honorary secretary, but we all know we have only one, and that is Mr. Fearnley. I shall nominate him. You know his value, and I need not enlarge on it.

The motion was carried unanimously.

On the motion of Councillor HEAP (Burnley), Mr. Simpson was unanimously reappointed auditor, and on the suggestion of the President the Town Clerk of Liverpool and the Town Clerk of Ilkeston were appointed honorary solicitors.

Alderman G. BANTON (vice-chairman, Leicester).—I would suggest that the Executive should take into consideration the advisability of having three days for our conference. There has not been a fair opportunity this time for the discussion of some of the valuable papers we have heard. I would also suggest that we should ask some of the engineers to bring forward the electrical side a little more prominently, considering the vast importance that it has on the work of the Association.

**Alderman S. Flint, J.P.**

*The New President of the Municipal Tramways Association.*

Alderman SPENCER.—It occurs to me that when sending out papers, gentlemen should be asked to put down their names if they wish to speak. We should then know how long the discussion would take, and whether it would be advisable to carry it over to another day.

The PRESIDENT.—The Executive will take into consideration these suggestions. In the days before the war we did meet for three days, and very often we were pressed for time then. In the future business will be of growing importance, and probably the Executive will decide in favour of three days.

Alderman FLINT.—I beg to move a vote of thanks to the president for the way in which he has discharged his duties during the past year. He is a *persona grata* to all of us, owing to his geniality and good temper. He has endeared himself to all of us, and when we think of the way in which he has discharged his duties we are filled with admiration. Last year was one of the worst years in carrying on the work of this Association. We have been deprived of the services in large measure of some of our colleagues, so that the work has devolved almost entirely on the president and the secretary. The president has devoted himself admirably to the work of the Executive Council as well as to this conference. No one could have done the work better. He is a practical man, and he knows the ins and outs of the whole thing. He has been at the service of the

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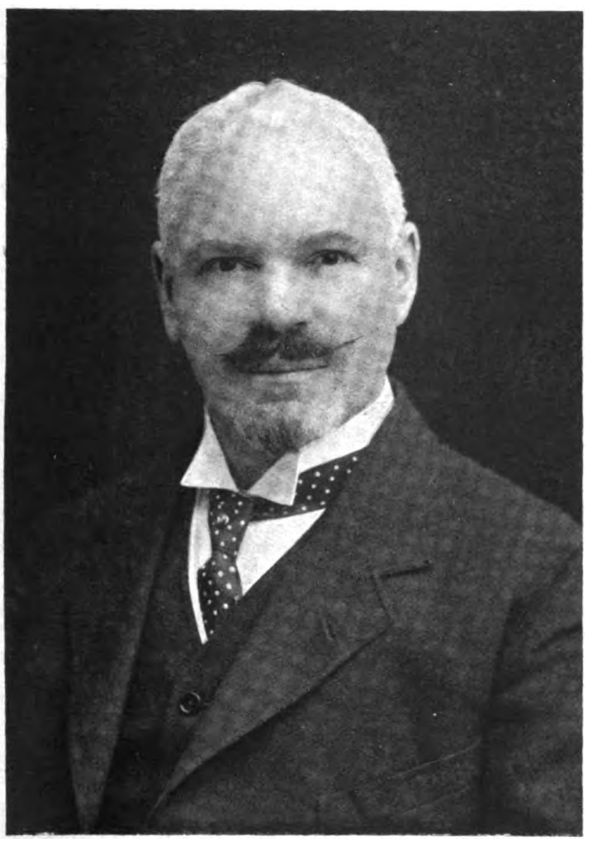
Association, and has devoted himself to the work most untiringly and thoroughly. I have great pleasure in moving that our very best thanks be offered to him for his services.

Alderman WYLIE.—I second that motion with great pleasure. I am sure we all appreciate very much the manner in which the president has conducted the business during the past year. I trust that now he joins the ex-presidents we shall long have him among us to give us the benefit of his experience.

The motion was carried unanimously.

The PRESIDENT.—I give you my most hearty thanks for the very kind and appreciative way in which you have proposed and carried this vote of thanks. I need not say much except that it has always been a pleasure to me to assist at our conferences, and especially during the past year the work has been most pleasant. We have had many useful meetings of the Executive Council, and we all realise that in the immediate future there is more important work, and I hope I shall be spared to give what assistance I can. (Hear, hear.) We all know that during this tremendous war we have had many anxieties, and it has been a great pleasure to me to know that we are keeping our end up in this country, that we are not getting downhearted, that we are maintaining our businesses as far as practicable in first-class condition, ready for the boys when they return home, and when they will find we have not been neglecting their interests. I have again to thank you, and to say how glad I am that I have been allowed to hold this position. (Applause.)



**Mr. T. B. Goodyear.**
*Vice-President, Municipal Tramways Association.*

Alderman F. A. DUNSFORD (chairman, Southampton Tramways Committee).—I have much pleasure in moving :—" That the best thanks of the Municipal Tramways Association be given to the Blackpool Corporation and to the Mayor and the chairman and members of the Blackpool Tramways and Electricity Committee for their cordial reception, for the splendid facilities afforded to the delegates, and for their generous hospitality during our stay in Blackpool ; to Mr. Charles Furness, borough engineer and tramways manager, and his assistants, for their efforts in assisting in making the conference so enjoyable and successful ; and to Mr. J. Cameron and Mr. H. W. Laing for the greatly appreciated facilities extended to the delegates."

The Mayor, in welcoming the conference yesterday, talked of Blackpool breezes ; we have experienced the breezes, and this morning we are experiencing them in a more gentle way. There is only one cloud over us, and that is the missing of Alderman Brodie, who was an original member of the Association. That the conference this year has been a great success we are all agreed.

Councillor FRYER.—I have much pleasure in seconding this motion. When the Mayor, representing the Corporation of Blackpool, came here yesterday to extend a welcome to this conference, we listened with pleasure to his sincere and kindly remarks, and the conference has reason to value the generous manner in which his Worship bore testimony to the importance and far-reaching character of the work of this conference. The conference, I am sure, will feel it appropriate if I say a word or two about the public spirit and go-ahead enterprise of the Corporation of Blackpool. No effort has been spared in this borough for a number of years to improve and to adapt all the local advantages. We know to what an extraordinary extent this Council has succeeded. We as tramway people feel that they have anticipated one of the chief movements of the future. That is the special track and the single-deck car. They are a go-ahead people, and the conference has done well to come here. We would like this motion to be taken as a sincere expression of our appreciation and gratitude for the good things done for us in Blackpool.

The motion was carried unanimously.

Mr. CHARLES FURNESS (general manager, Blackpool Corporation Tramways).—It gives me great pleasure to say how pleased the Mayor and the Tramway Committee are to welcome you to Blackpool. It is part of the business of Blackpool Corporation to receive visitors. We have no industries here ; we take people in—(laughter)—but we take them in in a very nice way. I hope we have taken you in and made you very welcome. (Applause.)

Mr. A. BAKER.—We are forgetting our honorary secretary, the man who stepped into the breach when Mr. Spencer had to decline the duties, and we know no better man could occupy the position than Mr. Fearnley. (Applause.) Mr. Fearnley had a spell of five or six years as honorary secretary before Mr. Spencer came in. We know how he did his work then, and we know how he is doing it now. I am sure you would not like this conference to break up without expressing our hearty thanks for the work Mr. Fearnley is doing and in anticipation of what he will do in the future. (Applause.)

Mr. HOLFORD seconded the motion, and it was carried unanimously.

Mr. FEARNLEY.—I am exceedingly obliged to you, and I am delighted to do anything I can for the Association. It is a pleasure to take the place of Mr. Spencer for the time being, and I will continue it this year and do all I can for the Association. (Applause.)

This concluded the business.

## ANNUAL REPORT OF THE EXECUTIVE COUNCIL.

The report of the Executive Council on the work for the past year was as follows :—

### ANNUAL CONFERENCE.

Due to the continuance of the European war, the council decided, on the suggestion of the president, to hold business meetings at Blackpool in lieu of the usual annual conference, devoting one day entirely to the discussion of papers and the second day to the annual general meeting.

### RESIGNATIONS.

The following have retired from the Association during the year :—

Ilkeston Corporation.

L. C. F. Bellamy, borough electrical engineer and manager. Ilkeston Corporation Tramways.

W. Boot, Rolling Stock Superintendent, Nottingham Corporation Tramways.

C. W. Mallins, General Manager, Liverpool Corporation Tramways.

### OBITUARY.

The council regret to record the deaths of Ald. J. Miles, J.P., chairman of the Bolton Corporation Tramways Committee, late vice-president of the Association ; and of Ald. J. Brodie, J.P., chairman of the Blackpool Corporation Tramways and Electricity Committee, who had been members of the Association for a number of years.

### MEMBERSHIP.

Appended is a summary of the members for the past two years :—

| | 1915-16. | 1916-17. |
|---|---|---|
| Honorary members ... ... ... | 1 ... | 1 |
| Local authorities ... ... ... ... | 76 ... | 75 |
| Managers and assistants ... ... | 112 ... | 109 |

### MEETINGS OF THE EXECUTIVE COUNCIL.

Seven meetings of the council have been held since the last annual meeting—at London, Manchester, Sheffield, and Bradford. There have also been a number of meetings of special committees and sub-committees appointed to deal with specific matters, who have reported to the council periodically.

### MOTOR OMNIBUSES—INCOME-TAX ASSESSMENTS.

A joint committee, comprising representatives of the Municipal Tramways Association (Incorporated), the Tramways and Light Railways Association, the London Omnibus Owners' Federation, the Provincial Omnibus Owners' Association (Incorporated), and

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the Institute of Municipal Treasurers and Accountants (Incorporated) have been in negotiation with the Chief Inspector of Taxes, with a view to an agreement as to the proper allowance to be granted in respect of the wear and tear of motor omnibuses.

As the result of these negotiations the Board have agreed to the following proposals :—

(*a*) That the allowance for the four years commencing with 1916-17, in addition to any appeals at present outstanding for prior years, be 20 per cent. on the written down value.

(*b*) That at the end of the said period the rate be reconsidered.

(*c*) That as regards excess profits duty cases, inasmuch as the rate is intended to be regarded as a special rate necessitated by the war, it be applied to all accounting periods where claimed.

(It should be noted that where more than 20 per cent. is already being allowed the reduced rate is to be applied.)

These proposals do not apply to commercial motor vehicles.

Mr. J. M. McElroy (Manchester), and Mr. C. J. Spencer (Bradford) are the representatives of the Association on the joint committee.

THIRD PARTY INSURANCE.

As a result of various inquiries from motor omnibus operators, negotiations have taken place with the Accident Offices Association with a view to an alteration being made in the method of insuring motor omnibuses. After consideration, the committee of the above association have signified their intention of dealing with future cases of insurance in the manner suggested by the association, namely, upon the basis of receipts and mileage.

INTER-CONNECTION OF ELECTRIC SUPPLY UNDERTAKINGS.

The council have had under consideration memorandum of the National Electric Power Supply Joint Committee (being a committee appointed by the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies) regarding the appended circular letter of the Board of Trade, dated May 25, 1916, on the subject of inter-connection of electric supply undertakings :—

" BOARD OF TRADE (Railway Department),
" 7, Whitehall Gardens, London, S.W.,
R.C. 1334. " May 25, 1916.

" Sir,

" INTER-CONNECTION OF ELECTRIC SUPPLY UNDERTAKINGS.

" The Central Coal and Coke Supplies Committee have had under consideration the increasing difficulty in providing for the supply of coal to important consumers, and have advised the Board of Trade that in view of the possibility of a serious shortage in the near future every practical economy in consumption should be adopted without delay.

" In this connection the Board desire to call attention to the very considerable saving that can be effected by the adoption of arrangements for inter-connection and joint working of electric supply undertakings, including inter-connection with stations supplying tramways and railways.

" The Board are aware of the difficulties involved at the present time, particularly in regard to labour and materials, but they are advised that in many cases the necessary arrangements could be made at once, and they wish therefore to urge upon electric supply undertakers the necessity in the national interest of taking immediate steps to avail themselves to the fullest possible extent of the powers which exist for the purpose.

" Any application which may be made to the Board of Trade for their approval of such arrangements under the powers conferred on them by the Electric Lighting Act, 1909 (Section 4, sub-section 3), and the London Electric Supply Acts, 1908 and 1910, will receive their immediate attention.

" The Board are prepared to assist as far as possible in cases where difficulty is experienced in securing the agreements of all the parties interested in any proposed scheme or in arranging the terms and conditions under which it shall be carried out.

" I am, Sir,
" Your obedient servant,
" W. F. MARWOOD."

The council expressed themselves in favour of the principle of linking up, and offered to illustrate where such inter-connection had taken place with public advantage.

INSULATION OF POST OFFICE WIRES.

A communication was received from the General Post Office, dated December 8, 1916, respecting the agreement arrived at in 1913, whereby insulated wire instead of bare wire is provided at crossings, and pointing out that owing to the increased cost these charges do not now represent the amount due from the tramway undertakings on the basis then arranged, and it was suggested that the charges of 11s. 6d. per circuit where the Postmaster-General is first comer, and of 5s. 9d. where he is second comer should, owing to the extra cost involved, be increased to £1 and 10s. respectively ; the revised charges to come into operation on January 1, 1917. The cost and the propriety of the relative charges to be examined from time to time.

It was agreed to recommend the members to pay the extra cost suggested for the provision of insulated wires under the present circumstances.

LIGHTS (VEHICLES) ORDER, 1916.

The Order of the Secretary of State, dated October 19, 1916, framed under Regulation 2 of the Defence of the Realm (Consolidation) Regulations, 1914, as to lights on vehicles in places outside the Metropolitan and City of London Police Districts provided (*inter alia*) as under :—

(1) Every vehicle on any street, highway or road to which the public have access in any part of England or Wales, excepting the Metropolitan and City of London Police Districts between half an hour after sunset and half an hour before sunrise must carry lamps as follows :—

(*a*) At the front, a lamp or lamps displaying to the front a white light. If only one lamp is carried for this purpose on any vehicle other than a bicycle, tricycle or handcart, it must be placed on the extreme off, or right-hand side of the vehicle ; if a second lamp is carried it must be placed in a corresponding position on the extreme rear, or left-hand side of the vehicle, and

(*b*) At the rear, a lamp displaying to the rear a red light. The lamp carried for this purpose on any vehicle other than a bicycle, tricycle, or handcart must be placed on the off or right-hand side of the vehicle.

In face of the attitude of certain chief constables in the country, negotiations were opened with the Home Office, and the assurance was given that their communication, dated January 22, 1916, exempting tramcars from the Order, dated December, 1915, as to the position of lights still held good, but that the Home Office felt that some modification of tramcar lighting would have to take place.

A deputation, comprising the President (Mr. H. Mozley), and Messrs. J. B. Hamilton, J. M. McElroy, and C. J. Spencer, had an interview with Mr. A. L. Dixon at the Home Office on November 3, 1916, and after discussing the whole position both from an operator's and pedestrian's point of view, it was agreed on behalf of the Home Office to recommend that tramcars be exempted from the recent Order, and an undertaking was given that chief constables in the various areas would be notified. The opinion was expressed, however, by the Home Office that a gradual application of the Order would probably have to take place, but before anything was done in that direction opportunity would be afforded tramway operators to discuss the matter.

TRAMCAR (INTERIOR) LIGHTING.

The question of tramcar (interior) lighting having become a very serious matter throughout the country, due to the restrictions imposed by the military authorities in certain districts, a communication was sent to the Board of Trade drawing their attention to the number of accidents in connection with the operation of tramcars on the various undertakings, and pointing out that it was quite unnecessary to have the cars darkened to the extent insisted upon, especially on those undertakings away from the danger zone, having regard to the fact that it was possible to cut off the current from the line at a very short notice.

The president (Mr. H. Mozley) and Mr. J. B. Hamilton (Leeds) had an interview with Mr. A. L. Dixon (Home Office) and the Hackney Carriage Inspector for the Metropolitan Police on December 29, 1916, when the undermentioned scheme was put forward :—

(1) That normal lighting should be granted to tramway operators on account of it being possible to cut off the whole of the current at the power station. They were therefore in the same position as munition works and controlled firms, in which cases there were no restrictions of lighting. The advantage to be derived from the additional lighting would be the general brightening up of the streets and consequently safer conditions for pedestrians, tramway passengers, and vehicular traffic.

(2) That if they were unable to grant this, a greater amount of light should be allowed to be shown from dash lamps. The necessity for this is evidenced by the frequency of pedestrians being run down by street cars.

The following communication was subsequently received from the Home Office :—

" HOME OFFICE, Whitehall, S.W., March 20, 1917.

" Sir,

" In reply to your letter of the 7th inst., regarding the lighting of tramcars, I am directed by the Secretary of State to say that chief officers of police have been authorised to allow the use of such lights on tramcars as they consider necessary for safe driving, providing arrangements are in force for extinguishing, within five minutes of the receipt of warning of the approach of hostile aircraft, all lights except those which must be retained to indicate the position of the cars whilst they are being run back to the depots or remain stopped in the streets as the case may be.

" Instructions to this effect have been issued since the interview to which you refer.

" As regards headlights, they have been instructed that it is not advisable for bright unscreened headlights to be used under the

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present conditions of street lighting, in view of the danger of pedestrians and drivers of other vehicles being dazzled thereby and prevented from seeing where they are going.

"From reports received from chief constables and from personal enquiries in one or two of the larger provincial centres the general opinion appears to be that a satisfactory driving light is obtained by covering the headlights (if these are of ordinary power) with a light coating of paint or distemper, and this avoids the danger caused by the use of unscreened headlights.

"As regards tramcars in the Metropolitan Police District, the Secretary of State understands that the London County Council have dispensed altogether with the use of headlights on their cars, and that headlights obscured as above are used on other tramway systems with satisfactory results.

"I am, Sir,

"Your obedient servant,

"(Signed) EDWARD TROUP."

The council are not satisfied with the present position, and the matter is receiving further attention.

SUBSTITUTION SCHEME AND RETENTION OF MEN.

With a view to releasing further men from tramway undertakings, negotiations have taken place with the War Office in order that every assistance might be given them in connection with the raising of additional men for the army. Through the kind offices of Sir James Hill, Bart., M.P. (Bradford), the Hon. Secretary (Mr. C. J. Spencer) obtained an interview with Lord Derby and discussed the matter. Negotiations were subsequently opened with Major Noel French, and a small deputation of the council afterwards waited upon Major Henderson and another representative at the War Office on December 5, 1916, when details of a substitution scheme were agreed upon.

Under the scheme tramwaymen under 30 years of age and classified as Class "A" men were to be released from tramway undertakings, on the understanding that an equal, or larger number of men, at present in the army, and of low medical category, would be substituted.

Full details of the scheme were circulated among the members.

A considerable number of men of military age and fitness have been released from the various undertakings and substitutes provided.

Since the arrangement with the War Office, the age limit of traffic employees under the certified occupations list has been raised to 31 years in respect of married men, and to 41 for single men.

TRAMWAY SUPPLIES.

In view of the urgency of conservation of material, the Ministry of Munitions approached the Association and other kindred bodies on the question of economy in material on the various undertakings, pointing out that the priority branch would like to feel satisfied that before ordering new material such as cars, rails, tires, etc., every endeavour had first been made to ascertain whether such requirements could not be obtained from—

(*a*) Other tramway undertakings who might have surplus stock or

(*b*) The Government, who in this connection are holding up material ordered for tramway undertakings abroad.

On January 22, 1917, a joint conference of the Municipal Tramways Association, the Tramways and Light Railways Association, and the Ministry of Munitions (represented by Mr. H. C. Coventry) was held in London.

A list of tramway material, including tires, points, cars, etc., intended for export, was submitted by the Ministry, and it was found that a portion of the items set out on the list would be of use to operators in this country, and arrangements were made for their disposal.

With a view to further assisting the Ministry in economising in respect of supplies, the members of the two associations were circularised and their requirements ascertained, and at the same time they were asked if they had any surplus stock or material for disposal. Lists showing material for disposal and material required have been sent round monthly, and in this way the undertakings have been able to assist each other. Some difficulty has been experienced in obtaining portions of tramcar equipment material, especially steel and malleable iron. Shortage of copper has also been felt in the various undertakings, and at the request of the Ministry a summary of the estimated requirements for maintenance purposes has been supplied, and permits granted for such quantities.

EMPLOYMENT OF WOMEN ON TRAMWAY UNDERTAKINGS.

The number of women employed on tramway undertakings has been greatly augmented during the year, and at the present time women are engaged as drivers, conductors, and cleaners, inspectors, timekeepers, storekeepers, labourers in the repair shops, and on the permanent way gangs, etc. They are also largely employed in filling vacancies on the general office staffs and as cash clerks.

WOMEN DRIVERS IN THE METROPOLITAN AREA.

At the invitation of Mr. J. W. Larke, of the Ministry of Munitions of War, the following attended a conference on February 16, 1917, at 6, Whitehall Gardens, London, to discuss the possibility of training women and ineligible men as tramcar drivers in and around London :—

Mr. J. W. Larke, Ministry of Munitions, in the chair.
Mr. J. Dalrymple, Glasgow Corporation Tramways.
Mr. A. R. Fearnley, Municipal Tramways Association.
Mr. A. de Turckheim, Tramways and Light Railways Association.
Mr. A. V. Mason, South Metropolitan Tramways.
Mr. A. Pott, North Metropolitan Tramways.
Mr. J. K. Bruce, London County Council Tramways.
Supt. Bassom, Public Carriage Department, Metropolitan Police
Mr. Howard Williams, Ministry of Munitions (Railways).
Mr. H. G. Humphreys, Ministry of Munitions.

In response to an enquiry it was found that at that date 16 municipal tramways undertakings were employing women drivers.

Mr. Dalrymple, of Glasgow, stated that they had 220 women driving tramcars in that city, with satisfactory results.

TRAMWAYS IN WAR-TIME.

Considerable assistance has been given by the various undertakings in connection with the transport of material for military purposes and in raising funds for national and other objects.

Valuable aid is also being given to the Government by various members of the Association.

MUNITIONS OF WAR ACTS.—LEAVING CERTIFICATES.

On February 19, 1917, the Ministry of Munitions issued an Order extending the provisions of Section 7 of the Munitions of War Act, 1915, as amended by Section 5 of the Munitions of War (Amendment) Act, 1916, as to leaving certificates to certified tramway undertakings.

INCREASING OF FARES.

The council have had under consideration the question of increasing the statutory fares. A resolution was passed by the Lancashire and Cheshire Tramways urging the Association to take the necessary steps to obtain an increase of statutory fare rates during the continuance of the extraordinary conditions attributable to the war.

Conferences have taken place with the Board of Trade, who have asked to be furnished with further information, and this is being dealt with.

ALTERATIONS TO ARTICLES OF ASSOCIATION.

The report of the council as to the future election of president of the Association having been adopted at the last annual meeting, certain alterations to the Articles of Association were necessary. Resolutions covering these are to be submitted to extraordinary general meetings for confirmation.

ELECTRIC VEHICLE COMMITTEE.

The Association is represented on this committee by Mr. A. R. Fearnley, Sheffield. Numerous meetings have been held during the year, and the report of the committee has already appeared in the technical press.

RAIL CORRUGATION.

No meetings of this committee have been held during the year, and only limited experimental work has been undertaken by the sub-committees due to the abnormal conditions throughout the country and the absence of members on military and Government work.

STANDARDISATION OF OVERHEAD LINE MATERIAL.

The question of standardisation of overhead line material has been under consideration. Due to the varied requirements of the undertakings in the country, the manufacture of the various supplies is carried on under great difficulties, and the Association has been approached by one of the large manufacturers with a view to some action being taken in this direction. The council have appointed the undermentioned committee to consider the advisability of standardising certain parts of the overhead line, and to report to the council thereon :—

SUB-COMMITTEE ON STANDARDISATION OF OVERHEAD LINE MATERIAL.

Mr. L. E. Harvey, tramways manager and engineer, U.D.C. Tramways, Ilford.
Mr. J. F. Simpson, borough electrical engineer and tramways manager, Preston.
Mr. W. Boot, rolling stock superintendent, Nottingham.
Mr. H. Dudgeon, overhead line superintendent, Birmingham.
Mr. W. S. Sturman, overhead line superintendent, Sheffield.
Mr. Weston, overhead line superintendent, Salford.

STANDARDISATION OF TRAMWAY RAILS, TIRES, AXLES, AND SPRINGS.

The sub-committee of the Engineering Standards Committee held a meeting on Tuesday, May 22, 1917, when further details with regard to profile of rail heads, sole plate bolt holes, height of tie-bar holes, position of bond holes, and standard tire profiles were fully dealt with.

The committee afterwards formally approved of the proposed revised sections of Nos. 2 and 4, and new sections 6 and 7, with the corresponding curved section.

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This brings to a close the labours of the committee (extending over three or four years) in regard to designing tramway rails so as to better adapt them to the requirements of present day service.

The committee then proceeded to discuss several matters with regard to the standard specification for tramway rails and fishplates, and the testing of rails.

MOTOR OMNIBUS TRAFFIC, ROAD MAINTENANCE, ETC.

No further action has been taken in this matter, the whole subject being in suspense until after the war.

The attention of members is drawn to the following special legislation which vitally affects municipal tramways :—

LOCAL GOVERNMENT (EMERGENCY PROVISIONS) ACT, 1916.

Prohibition of establishment of new routes for omnibuses.

20. (1) Notwithstanding anything in any statute, it shall not be lawful after the passing of this Act for any omnibus to ply for hire on or use any route which has not been regularly used by omnibuses plying for hire within two years prior to the first day of March nineteen hundred and sixteen, except with the consent of the highway authority, or, if more than one, every highway authority liable for the maintenance and repair of the highways along which the route runs, which consent may be given on such conditions as the highway authority may consider fit, or, if in the opinion of the Local Government Board such consent is unreasonably refused, or if such conditions are unreasonable, without the consent of the Local Government Board; and if any person drives an omnibus or allows an omnibus to be driven along any route in contravention of this provision, he shall, on summary conviction, be liable to a fine not exceeding five pounds, and to a further penalty not exceeding forty shillings for every mile travelled by every omnibus in contravention of the provisions of this section, all penalties recoverable under this section to be paid into the funds of the highway authority concerned.

Provided that nothing in this section shall apply where a route is altered in consequence of the temporary diversion of traffic on account of the breaking up of any road or in pursuance of the directions of any police authority or other directions lawfully given.

Provided also that nothing in this section shall apply to any omnibus plying for hire on or using any route in any case where the Admiralty, Army Council, or Minister of Munitions are of opinion that an omnibus service is necessary for and is to be used by munition workers or other persons engaged on Government war service.

(2) This section shall not be deemed to detract from any existing powers of highway authorities in regard to omnibuses.

(3) For the purposes of this section the expression "omnibus" includes every omnibus, char-a-banc, wagonette, brake, stage coach, or other carriage plying for hire or used to carry passengers at separate fares.

It has been noted that certain action is being taken by the County Councils' Association under these powers. The council is watching this, and if anything arises will take steps to safeguard the interests of the Association as far as possible.

RULE OF THE FOOTPATH.

The question of the rule of the footpath has had consideration by the council.

The following communication was received from Mr. J. Dalrymple, of Glasgow :—

"GLASGOW CORPORATION TRAMWAYS,
"17th March, 1917.

"A. R. Fearnley, Esq.,
"Sheffield.

"Dear Sir,

"RULE OF THE FOOTPATH.

"For some time I have been endeavouring to get the Corporation Watching and Lighting Committee, which has charge of the traffic on the streets, to take up the question as to whether pedestrians on the pavement should keep to the right or to the left.

"The committee were about to put up a large number of additional tablets to ask pedestrians to keep to the right, and at Thursday's Council meeting an amendment was passed sending the whole matter back to the committee for further consideration.

"I am persuaded that pedestrians on the foot pavement should keep to the left instead of to the right, and would like to know whether you have considered this matter and whether the Tramway Authorities could go into the question.

"I think you will agree with me, after looking into the question from a safety point of view, there is no doubt at all that pedestrians on the footpath should keep to the left.

"Yours truly,
"(Signed) JAS. DALRYMPLE,"
"General Manager."

The members were circularised on the matter, and of the 32 authorities who have dealt with this question 20 expressed themselves in favour of the recommendation for pedestrians to keep to the left.

The subject is to be discussed during the conference, and the council decided to defer consideration of the matter.

BOARD OF TRADE COMMITTEE ON ELECTRICAL SUPPLY.

The attention of the council was drawn to the constitution of the Electric Power Supply Committee appointed by the Board of Trade "to consider and report what steps should be taken, whether by legislation or otherwise, to ensure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development."

The committee as originally appointed was as under :—

ELECTRIC POWER SUPPLY COMMITTEE.

Mr. F. HUTH JACKSON (chairman).
Mr. J. FALCONER, M.P.
Sir CHARLES PARSONS.
Sir JOHN SNELL.
Sir JAMES DEVONSHIRE (Electrical Trades Committee).
Mr. JOHN KEMP } Coal Conservation Sub-committee of the
Mr. C. H. HERZ } Re-construction Committee.
Mr. J. F. CROWTHER (Irish interest).
Ald. C. F. SPENCER, of Halifax (Local Authorities owning Supply Undertakings).
Mr. G. H. HUME (London County Council).
Mr. A. J. WALTER, K.C. (Ministry of Munitions).
Mr. H. H. LAW (Local Government Board).
Mr. H. BOOTH (Board of Trade).

The council felt that the representation of local authorities on the committee was totally inadequate, having regard to the important part played by local authorities in the supply of electrical energy and the extensive character of the capital commitments in relation thereto.

The members were circularised on the matter and resolutions were passed by a number of authorities and forwarded to the Board of Trade, urging upon the President of the Board of Trade the necessity of increased representation being given to them, both in the interests of the ratepayers and consumers of electrical energy.

The Board of Trade subsequently decided to increase the representation of local authorities by appointing the following additional representatives :—

Mr. W. B. SMITH, member of Glasgow Town Council.
Mr. HAROLD DICKINSON, City Electrical Engineer, Liverpool.
Mr. E. F. VESEY KNOX, K.C., nominated by the Urban District Councils' Association.

As the Municipal Tramways Association is not represented on the committee, the council have communicated further with the Board of Trade.

INCOME TAX ON MEMBERS' ANNUAL SUBSCRIPTIONS.

The Association has been approached by the Inland Revenue authorities to enter into an agreement whereby subscriptions and levies paid by the members of the Association may be allowed as trade expenses in the individual accounts of the members in computing their income tax liability, on certain conditions, including :—

(*a*) That members receiving payments of any kind (other than loans and payments of a capital nature) bring the amounts received to the credit of their individual trading accounts, and that the Association furnish particulars yearly, to December 31, of the amounts paid in that way and to whom paid. In the event of any member or other person refusing to account for the tax on any such receipts in the ordinary course, the amount is to be included in the assessment upon the Association, i.e., by disallowing the items from the expenditure in computing the liability of the Association.

(*b*) That the payment of subscriptions, entrance fees and levies be allowed, and receipts by members from the Association, if any, be credited in the accounts of the individual members for the three preceding years in computing the assessment for the year.

In putting forward the agreement, the Inland Revenue authorities stated that their object was the reduction of labour entailed in dealing with the claims of the individual members.

The council fully considered the matter and decided to enter into the agreement put forward.

Members who pay their own subscriptions will therefore be entitled to include the amount as an expense in their income tax returns.

VICE-PRESIDENCY.

Due to the decease of the vice-president, Alderman J. Miles, J.P., a vacancy was created in this position.

The council approached Alderman S. Flint, J.P., chairman of the Leicester Corporation Tramways Committee, on the matter, and are pleased to be able to report that he agreed to accept the position.

READING OF PAPERS—ANNUAL CONFERENCE.

The question of reading papers at the annual conference has had the attention of the council, and the following rule has been adopted :

"That the general rule be adopted that the writer should give a synopsis of his paper, subject to the proviso that if he thinks he cannot give a satisfactory synopsis he be allowed to read the paper in full, with the permission of the president."

The council hope that this will meet with the approval of the members.

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MEETINGS OF MANAGERS' SECTION.

In accordance with the resolution passed at the meeting of the Managers' Section at the last annual conference in London, the council considered this matter early in the year and decided, in view of the extraordinary circumstances still prevailing, to abandon the half-yearly spring meeting.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—ANNUAL CONGRESS.

The Tramways and Light Railways Association very kindly extended invitations for representatives to attend their annual congress, and the president and secretary attended in that capacity and took part in the discussions.

RESIGNATION OF HONORARY SECRETARY AND TREASURER.

The council regret to report that due to the fact that Mr. C. J. Spencer, who has filled the position of Honorary Secretary and Treasurer for the past 5½ years, has been approached by the Admiralty to undertake certain duties in connection with the shipyard labour scheme, and as his Corporation had agreed to release him in order to enable him to take up his work, he sent in his resignation to the Association. Mr. Spencer kindly offered at the last annual general meeting to undertake the duties during the war, but circumstances had now arisen which rendered it impossible for him to continue in this capacity. The council had therefore no alternative but to accept the resignation, which they did with much regret.

The council requested Mr. A. R. Fearnley, general manager, Sheffield Corporation Tramways, who occupied the position prior to Mr. Spencer, to resume the duties *pro tem.*

FINANCE.

The council have to report that the finances of the Association are in a satisfactory state. The total income amounted to £378 3s. 6d., the balance of income over expenditure for the year being £53 7s. 10d. and the available balance (excluding reserve fund) £281 6s.

By order of the Executive Council,
HENRY MOZLEY, *President.*
A. R. FEARNLEY, *Hon. Secretary (pro tem.)*

## LUNCHEON BY BLACKPOOL COMMITTEE.

After the annual meeting the members of the conference were entertained at luncheon at the Hotel Metropole on the invitation of the Blackpool Tramways and Electricity Committee. Councillor R. Holt, Deputy-mayor and vice-chairman of the Blackpool Tramways and Electricity Committee, presided. He was supported by several members of the Corporation. After the luncheon,

Mr. HOLT, in welcoming the delegates, said he had to apologise for the absence of the Mayor, who had intended to be present, but who was slightly indisposed. He proposed the toast of the Municipal Tramways Association, and said that the Tramways and Electricity Committee of Blackpool were extremely pleased to receive the Association. The committee hoped the members of the Association would not be long before they came again. After the war was over the committee would try to show them what kind of welcome they could give to the Association. (Hear, hear.) The late Alderman Brodie was one of the original members of the Association, and he was one of the oldest chairmen in point of service of any tramway committee in England. They had electric traction at an early date in Blackpool, and Alderman Brodie was the chairman 17 years ago. There was no one more interested in tramway work.

Mr. MOZLEY said it afforded him great pleasure to respond to the hearty words of the Deputy-mayor's welcome. Mr. Holt had spoken of their old friend, Alderman Brodie, but they ought not to forget their other old friend, John Lancaster. It increased their regret that he could not come and share in the welcome. Both these men were conspicuous for their courtesy and were always helpful in the way of business. He (Mr. Mozley) thanked the town of Blackpool, as represented by the vice-chairman of the Tramways Committee, for the kindly welcome and for the arrangements for the conference being held there. Above all, his own tramways committee, that of Burnley, were very much obliged to Mr. Holt, because it was impossible to provide the accommodation necessary for a conference of this magnitude in a town like Burnley. It was an old bargain between Alderman Brodie and himself that if ever he (Mr. Mozley) had the honour to be president of the Association, Alderman Brodie would arrange that the conference should be held at Blackpool. The outside public should realise that this was an association which represented a great interest in the country. They had 88 municipal authorities members of the Association; they employed 55,000 men in ordinary times; 30,000 of these were now fighting for their king and country (applause), and the allowances for dependants of these fine men, two-thirds of whom had volunteered, amounted to £1,437,000.

Sir JOHN COURTIS proposed the toast of the town of Blackpool, and especially the Tramways and Electricity Committee.

Councillor H. BROOKS (vice-chairman, Blackpool Tramways and Electricity Committee) responded, and in further welcoming the members of the Association mentioned that this had been a record year for the Blackpool tramways.

The members of the conference were afterwards photographed in a group and were then taken by cars to St. Ann's-on-Sea, where they visited the new public gardens and a large open-air swimming bath.

## WOMEN TRAMWAY WORKERS' CLUB AT BIRMINGHAM.

An interesting ceremony took place in Birmingham on September 27, on the occasion of the opening by the Lady Mayoress (who was accompanied by the Lord Mayor, Alderman A. D. Brooks) of club rooms in Manchester Buildings provided by the Corporation for the use of the women tramway employees. The visitors, who were entertained to tea by the chairman of the Tramways Committee (Councillor Harrison Barrow), included members of the Tramways Committee, the town clerk (Mr. J. Beaumont Jones), the general manager (Mr. Alfred Baker) and the chief officers of the department, representatives of the conductresses' committee, and the department's two lady welfare workers, Miss L. Keep and Miss E. M. Wayland. Councillor Harrison Barrow drew attention to the considerations which had prompted his committee to provide the rooms. There were now 1,500 women employed, many of whom had been imported into the city, and a large number had to seek lodgings that were more or less uncomfortable. The hours of the girls were irregular, and although they did not ordinarily exceed eight per day, they were spread over 12 or 14 hours. Thus a girl might be required at 5 a.m. for a four-hour turn, and in the evening for another four hours. The problem had been what to do during the remainder of the day. The married women, of course, generally found their spare hours in the middle of the day an advantage in looking after domestic affairs. With single women it was different, and a large number had been obliged either to stop in the mess rooms at the depots or to wander about the streets. It was to

**Dining Room of Tramway Workers' Club, Birmingham.**

overcome this drawback that the committee had provided the club rooms. No effort had been spared to make the premises attractive and home-like. There was a large room where the girls would be able to meet and obtain suitable refreshments at reasonable prices. Newspapers, periodicals, and games would be provided, and entertainments given. There was a second large room, which would be used principally as a rest and reading room, with easy chairs, couches, etc., and a small library was being formed. It was also felt very desirable that members should be able to sit down quietly to correspond with their friends. The management would be in the hands of a committee of women elected by the employees. Miss Keep and Miss Wayland, two ladies employed to look after the welfare of the women, would act respectively as chairwoman and secretary. The catering would be undertaken by the head office. To ensure the club being run on good lines a panel of 50 girls would be formed. From this panel one or two girls would be selected as responsible officers for the day. It was desirable that the girls should feel that they themselves were taking a good share in the management, and in this way it was hoped that the best results might be obtained. The Lady Mayoress, in declaring the rooms open, paid an eloquent tribute to the accommodation provided, and complimented the women on the way they were endeavouring to carry out men's work. She was glad that it had been realised that women needed different treatment to men, and that the Tramways Committee had taken steps to meet the need. The aim of the committee had been to create a happy family feeling. The best way in which the girls could show their gratitude would be by cultivating this spirit, and by trying to be noble-minded and endeavouring to smooth their personal troubles.

**Lighting Relaxations.**—While there is now no cause of complaint with the lighting of the streets and public conveyances of the Metropolis, some provincial towns are still endeavouring to secure improvements. Included in the number are Birmingham, Bradford, and Cardiff. A concession in the latter place is the removal of the discolouring from the windows of the tramcars.

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## FINANCIAL REPORTS AND MEETINGS.

**Madras Electric Tramways** have declared an interim dividend on the ordinary shares for the half-year ended June 30 at the rate of 8 per cent per annum.

**Dumbarton Burgh and County Tramways Company.**—The board announce a dividend of 3½ per cent. on ordinary shares for the past year, transferring £1,673 to the redemption account, £5,000 to the renewal fund, and £2,000 to the reserve, leaving £2,268 to carry forward.

**Chloride Electrical Storage Company.**—The report for the year ended March 31 last shows, after making provision for depreciation and for the reduction of investments to market value, and for war taxation, a profit of £35,459. Dividends amounting to 10 per cent. have been paid, free of income tax, on the ordinary shares, and the directors now recommend a transfer of £20,750 to reserve fund, making £22,500, and to carry forward the balance of £15,323.

**Ayr Corporation Tramways.**—Treasurer Ferguson, at a meeting of the Ayr Town Council, mentioned that the tramway undertaking had had a very successful year. The receipts, which amounted to £21,074, were a record for the system, and £1,789 more than those for 1915-16. The working expenses showed an increase of over £1,000. The surplus was £300, as compared with a deficit of £16 in the previous year. The balance at the credit of the depreciation account was £16,249, and the reserve fund stood at £4,932.

**Aberdeen Suburban Tramways Company.**—At the half-yearly meeting of this company on August 27, Mr. James Mearns, who presided, said that the net profit had slightly increased. There had been a gratifying rise in the revenue, and had it not been for the greatly increased expenses, they would have had a very good half year's business. The credit balance was £3,310, which the directors proposed should be dealt with as follows:—To place at credit of depreciation and renewal account, £1,200, bringing that account up to £17,900; to pay a dividend at the rate of 5 per cent. on the capital, which would absorb £1,561; and directors' fees, £31, leaving a balance of £517 to carry forward. The report was adopted and the directors were voted a further £100 of remuneration.

**Tyneside Tramways and Tramroads Company.**—Owing to the indisposition of the chairman, Dr. J. T. Merz, the vice-chairman, Mr. J. E. Henderson, presided at the half-yearly meeting of this company held on August 29. After giving a summary of the accounts, a statement of which was included in a previous issue, Mr. Henderson said the increased dividend on the ordinary shares at the rate of 4 per cent. compared with 1¾ per cent. paid previously. An increased amount was placed to reserve, and a larger sum was carried forward. In reply to a letter from a shareholder objecti·g that a larger dividend was not declared, the chairman said that the times were not normal. Any increased traffic receipts which might be due to decreased railway facilities and increased fares should be considered abnormal, and the directors thought they would better keep a large sum in hand. A proposal to increase the remuneration of the directors, which had stood at £175 per annum since February, 1903, to £300 per annum, was adopted. A resolution authorising the directors to make a contribution of ten guineas to the Royal Infirmary, and to expend a sum not exceeding £200 on war charities in the half-year was also carried.

**Walter Scott, Limited.**—At the annual meeting of the shareholders of Walter Scott, Limited, in Newcastle on August 29, Sir William Stephenson, who presided, moved the adoption of the directors' report, which showed profits of £127,000 and recommended a dividend of 15 per cent. He said that the company's steel works had remained "controlled," and the difficulties of working had been accentuated by the appointment of a Coal Controller, but the year was, perhaps, taken all round, the best since the company was formed 17 years ago. The steel works at Leeds had been fully employed, and while the output had not quite reached that of the previous year, the receipts had increased by over £200,000, although prices had been largely controlled by the Ministry of Munitions. After meeting extra costs and providing for taxation, they had been able to lay aside a large sum to meet future contingencies. They were now wholly engaged on Government work, and had a big order book, which would keep them fully employed for many months. With regard to the collieries, despite the demands for men for the army, the output increased by the same amount as it was down in 1915-16—25,000 tons—and the receipts increased considerably, while they had remunerative contracts for many months ahead.

## PERSONAL.

**Mr. J. C. Whiteley,** general manager and engineer of South Shields Corporation Tramways, has been granted an increase in salary of £100 per annum.

**Mr. C. W. Mallins,** general manager of the Liverpool Corporation Tramways, has been granted an increase in salary from £1,250 to £1,500 per annum.

**Dundee Town Council** has granted a war bonus of 7½ per cent. on the salaries of the burgh engineer, the water engineer, and the tramways manager.

**Mr. R. S. Pilcher,** general manager of Aberdeen Corporation Tramways, has been granted an increase in salary of £100, in two yearly instalments of £50.

**Mr. R. Collins,** of the Belfast staff of the Edison-Swan Electric Company, has been appointed engineer and manager of the Galway Electric Supply Company.

**Mr. Thomas Copp,** permanent way foreman for the Peterborough Electric Traction Company, has been appointed permanent way inspector of the Cape Town Tramways.

**Mr. F. H. Rudd** has been appointed chief engineer of Rochdale Corporation Electricity Department at a salary of £400, increasing by two annual increments of £50 each to £500.

**Messrs. Kincaid, Waller, Manville, and Dawson** have removed their offices to 3, Central Buildings, Westminster, S.W.1; St. Stephen's House, their previous address, having been requisitioned by the Government.

**Mr. J. Wilkinson,** tramway electrical engineer, Hull, has returned to business after a serious illness of several weeks' duration, and will be glad if his business friends will note his new address, Tramway Power Station Buildings, Osborne Street, Hull.

**Mr. R. Birkett,** borough electrical engineer and tramways manager of Southend-on-Sea, has been requested to serve temporarily with the Coal Control Board, but owing to the depletion of their staff, the Council found it impossible to grant Mr. Birkett leave of absence.

**Mr. G. Webster,** general manager of Rochdale Corporation Tramways, has been recommended by the Tramways Committee to receive an increase in his salary from £450 to £500 a year. Warm appreciation of Mr. Webster's services was expressed by several members.

**Mr. R. R. Greene,** tramway manager of Wallasey Corporation Tramways, has been granted an increase in salary from £550 to £650 by four annual instalments of £25 each. The same increase, also by four instalments, was granted to **Mr. J. H. Crowther,** the electrical engineer, whose present salary is also £550.

**Mr. W. G. T. Goodman,** chief engineer and general manager of the Adelaide Municipal Tramways Trust, recently arrived in London after spending some time in the United States. The voyage from New York occupied three weeks, and provided some interesting experiences. Mr. Goodman is president of the Tramway Officials Association of Australia, and just before leaving Adelaide he was elected president of the Federal Council of the Australian Electrical Association.

**Mr. John Wardle,** commercial manager of the Metropolitan Railway, has been appointed by Lord Rhondda to control cold storage and inland transport of food. Mr. Wardle studied the methods of the great American meat chilling companies during his visits to the United States. He commenced his railway career with the Lancashire and Yorkshire Railway in Manchester, and during ten years gained a large experience in railway and dock work. He then left Britain to take up a position with the Grand Trunk Railway of Canada. Returning to Britain, he became London traffic manager of the same railway, and in 1908 joined the Metropolitan Railway.

**Mr. George Salter,** chairman of George Salter and Company, Limited, died on August 31, at Stourbridge, at the age of 61 years.

**The late Mr. W. S. Laycock,** of Oakbrook, Fulwell, Sheffield, head of the firms of W. S. Laycock, Limited, and Cravens, Limited, Sheffield, manufacturers of railway material, left estate valued at £71,145.

**Will of Sir George White.**—Probate of the will of the late Sir George White, Bart., late chairman of Bristol Tramways and Carriage Company, and founder of the first aeroplane factory in this country, has been granted to his only son, Sir Stanley White, Bart. The will, which is dated July 15, 1916, provides for the division of the whole of the deceased's unsettled property in certain proportions between his son and only daughter, Mrs. Ernest J. Hudson. Probate has been taken out upon a gross sum (exclusive of the value of property settled or transferred in the lifetime of the deceased) of £185,000, with net personalty of £137,000.

**Alderman John Miles's** death during the first week in September, occasioned great regret on the part of the Mayor and Corporation and townspeople of Bolton. The expressions of grief and condolence were equally marked at the annual conference of the Municipal Tramways Association, for last year Alderman Miles was elected vice-president, and would this year have been elected to fill the office of president. In moving his election as vice-president, Mr. Holford (general manager, Salford), remarked that he did not know a more courteous gentleman. He was always willing to do anything for tramways in connection with the Association and with the work of the Lancashire Association. In acknowledging his unanimous election, Alderman Miles said he took a very warm interest in the Association, and in his humble way he had also tried to do the best he could for his own town, which he loved so well. Alderman Miles was the "father" of Bolton Corporation, which he entered in 1874, and was twice mayor. He had been a member of the tramways committee from its formation in 1899, and for many years he had acted as chairman.

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### WITH THE FORCES.

**Mr. J. S. Green,** son of the borough surveyor of Haslingden, has been gazetted second lieutenant in the Royal Engineers.

**Signaller Sergeant F. Hall,** formerly in the employment of the Blackpool, St. Annes, and Lytham Tramways Company, is in hospital in France suffering from shrapnel wounds.

**Lieutenant-Colonel G. G. Ewer,** of the Essex Regiment, who has been awarded the D.S.O., was sales manager of the Stepney Council's Electricity Department. He is serving in Palestine.

**Company-Sergeant-Major R. Edwards,** York and Lancaster Regiment, who was a driver on the Rotherham Corporation tramcars, has been promoted to be Regimental-Sergeant-Major.

**Lieutenant E. Ivor David** has been appointed Captain in the R.F.C. (Equipment Department). Captain David was formerly manager of the British Thomson-Houston Company in South Wales.

**Sapper J. E. West,** West Lancashire R.E., and late of the United Electric Car Company's Works, has been awarded the Military Medal for bravery and devotion to duty. He enlisted in October, 1914.

**Sapper J. Gimmell,** R.E., who has been awarded the Military Medal for meritorious work performed under heavy shell fire, was formerly employed as a motorman on the Glasgow Corporation Tramways.

**Lance-Corporal E. T. Moore,** Royal Welsh Fusiliers, who before joining the army was in the employment of Cardiff Tramways, has been presented by the tramway employees with a gold watch and chain to commemorate the third award of the Military Medal to a Cardiff tramwayman. Mrs. Moore was the recipient of a gold chain and locket.

**Corporal Francis Archie Hirst,** R.F.A., has been awarded the D.C.M. for exceptional bravery on the battlefield in Flanders and volunteering for special observation work at great personal risk. Corporal Hirst was formerly an electrician in the Blackpool Corporation Tramways Department, and joined the signalling section of the West Lancashire Territorial R.F.A. in November, 1914.

**Private Tom Witham,** Coldstream Guards, who has won the Victoria Cross, was formerly in the service of the Burnley Corporation Tramways. His wife has received a letter from Mr. H. Mozley, general manager, in which he says:—"I cannot refrain from offering my congratulations to your husband upon his splendid services in the war, which are being acknowledged by the King in granting him the V.C., an honour which means so much, not only to the winner, but to those who are associated with him. Although he was not very long in our service before he volunteered for the war, we feel that a little of the glory he has won is reflected upon the tramway staff, and all of us are heartily proud of what he has done. Kindly give him my heartiest congratulations."

**A Patriotic Family.**—Captain Walter Courtis, R.E., youngest son of Major Sir John Courtis, chairman of Cardiff Tramways Committee, has been wounded in France, and is now in hospital in that country. The wound is in the left elbow, and is not serious. Prior to the war, Captain Courtis was an officer in the Glamorgan Fortress Royal Engineers. He has seen service in the East, and when at Sinai he volunteered to fill a vacancy in the East Lancashire Engineers, and was drafted to France early in the present year. The eldest son, Captain J. H. Courtis, Oxford and Bucks Light Infantry, was killed in the advance on Bagdad in November, 1915. The other son is Dr. A. O. Courtis, who has been a surgeon in the Royal Navy for over two years. Miss Courtis is doing war work in France, where the youngest daughter is also engaged as a motor ambulance driver. Sir John Courtis has organised the Cardiff and district section of Welsh Motor Volunteer Corps, in which he holds the rank of major.

## CONTRACTS AND ORDERS.

**Hadfields, Limited,** have accepted a contract to supply special trackwork to Manchester Corporation Tramways.

**Babcock and Wilcox, Limited,** have an order from Manchester Corporation for superheater tubes for Bloom Street Electricity Works.

**Messrs. Frederick Smith and Company,** of Halifax, have received an order for the supply of trolley wire to Glasgow Tramways Committee.

**Victoria Railways Department** have placed a contract with Noyes Brothers, Melbourne, for vulcanised rubber electric light wire at £17 17s. 6d. per mile.

**P. R. Baillie and Company** have a contract to supply 100 miles of rubber-insulated wire, at £2,800, to the New Zealand Public Service Stores Tenders Board.

**The British Westinghouse Electric and Manufacturing Company** are to supply a 300-KW. rotary converter set to Salford Corporation at £1,535, and switchgear at £551.

**Siemens Brothers and Company, Woolwich,** have a contract to supply feeder cable and feeder pillars, etc., to Kettering Council, at £1,737. There were eight tenders.

**Accrington Electricity and Tramway Committee** have placed an order with George Hargreaves and Company for 500 tons of coal per month for a year at existing prices, subject to any alteration made by the Coal Controller.

**Ilford Council** have accepted the following tenders:—Two rotary converters, General Electric Company; 4,400 yards of 6,600 volt cable, W. T. Henley's Telegraph Works; 3,600 yards of two-way stoneware conduit, Albion Clay Company.

**Ilford Council** have accepted the following tenders:—General Electric Company, Limited, converting plant, £2,459; W. T. Henley's Telegraph Works Company, Limited, cables, £1,432; Albion Clay Company, Limited, conduits, £526.

**Manchester Electricity Committee** has accepted tenders from Callender's Cable and Construction Company, Limited, W. T. Henley's Telegraph Works Company, Limited, C. Macintosh and Company, Limited, and the British Insulated and Helsby Cables, Limited, for the supply of cable.

**Contractors' Increased Costs.**—Glasgow Electricity Committee have advised the Corporation to allow an additional sum of £5,000 to Messrs. Babcock and Wilcox, Limited, on their contract price of £24,000 for providing and erecting a coal conveyor and transporter at the Dalmarnock generating station. The addition is to provide for the increased cost of labour and materials.

**Wolverhampton Council** have allotted the following contracts:—Messrs. Alley and McLellan, valves for pumping plant, £226; Rees-Roturbo Manufacturing Company, Limited, two motor-driven pumps, £384; Electric Construction Company, Limited, motors for new plant, £1,272; Film Cooling Towers, Limited, cooling towers, £5,444; J. Spencer, Limited, steam feed water pipes, £280.

**New Glasgow Generating Station.**—The Electricity Committee have recommended the acceptance of the appended tenders:—Reinforced concrete superstructure for a boiler house, turbine room, and workshop at the new Dalmarnock station, Messrs. Train and Taylor, £64,539; eight boilers, stokers with forced and induced draught, economisers, etc., Babcock and Wilcox, Limited, £140,282; 12 sets of switch gear, A. Reyrolle and Company, Limited, £33,985; 27 panels of additional switchgear at sub-stations, A. Reyrolle and Company, Limited, £14,210.

## TRAMWAY AND LIGHT RAILWAY NOTES.

### BIRKENHEAD.

HALFPENNY FARES DEFINITELY ABANDONED.

Birkenhead Council have rejected a motion by Alderman Byrne rescinding the recent increase of fares and instituting penny return tickets for the halfpenny stages recently abolished. Councillor Halsall, chairman of the Tramways Committee, mentioned that since the abolition of halfpenny and three-halfpenny fares the receipts had been the highest on record. Many towns had increased their fares, and others were applying for power to charge beyond the statutory limit of one penny per mile. The charges in Birkenhead were nothing near a penny a mile, and with regard to the halfpenny fares, if they lost them all it would only be equal to 1 per cent. of the total receipts. The committee had to face heavy expenditure, which would increase as they went on.

### COVENTRY.

INCREASED WAGES AND COSTS—DIMINISHING LABOUR SUPPLY.

The Council have granted the tramway employees an increase of a halfpenny an hour as from April 1 last. Councillor Wale, vice-chairman of the Tramways Committee, speaking at a recent Council meeting with reference to fares, said that they aimed at providing a service at fares as near cost as possible. They had to have regard to the department paying its way, and he emphasised the fact that wages and the cost of material had very greatly increased, with the result that the gross profits were steadily diminishing. The committee had passed resolutions to the effect that they had not sufficient men to give the service they would like, and that the increased cost must be passed on to the public. The recruiting authorities appeared to look upon a tramway concern as a milch cow for providing recruits, and owing to increasing scarcity of labour there was a probability of the Sunday services being discontinued.

### DOVER.

REDUCTION OF SERVICES.

The tramway service is to be reduced owing to the difficulty of obtaining drivers. Following the recent accident the committee have approved a recommendation of the coroner's jury to license tramway cars and drivers, and give to the police power to prevent overcrowding.

### DUNDEE.

THE RULE OF THE FOOTPATH.

The Dundee Tramways Committee have decided to support the movement in favour of a change in the rule of the footpath requiring pedestrians to "keep to the left." Mr. Fisher, the tramways manager, stated that the present rule of "keep to the right" had resulted in numerous accidents.

### GLASGOW.

INCREASING EMPLOYMENT OF WOMEN.

The latest figures issued as to the employment of women by Glasgow Corporation Tramways show that out of a total of about 5,600 employees 2,500 are women. Of these, 1,360 are conductors



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and 400 are drivers. In the power-station there are five female switchboard attendants. Eight women are employed in a like capacity in sub-stations, one sub-station being entirely staffed by women. Six inspectors of street switchboxes are women, while in the depots there are 490 female cleaners.

### LEICESTER.

REVISED FARES—PUBLICATION OF TRAFFIC RETURNS RESUMED.

The revised fares came into force on the Corporation tramways on August 20. In addition to the ordinary fares (introducing halfpenny stages on the outer portions of the routes) there will be a certain number of special fares, which are shown as follows:—Early return tickets, full distance (1½d. stage), 2d.; early return tickets, for any 1d. stage, 1½d.; outer transfer tickets, for any outer transfer stage, 2d.; inner transfer tickets, no alteration, 1½d.; children's tickets, no alteration, any 1½d. stage, 1d.; children's tickets, on halfpenny stages, same as adults, ½d.; soldiers' tickets. non-commissioned officers and men, no alteration, any 1½d. stage, ½d.; commissioned officers, ordinary fare. Outer return tickets are abolished. An experiment is being made in halfpenny fares on the outer zones only, the distance allowed being half a mile. The Tramways Committee have resumed the publication of the weekly traffic returns, so that ratepayers will be enabled to form their own opinion of the success of the new fares.

### NOTTINGHAM.

EFFICIENT LIFEGUARDS.

At an inquiry into the death of a child who was killed by falling in front of a tramcar at Nottingham, it was stated that 15 people and several dogs had been picked up by the lifeguards in Nottingham in the last twelve months. The evidence showed that the driver had no chance to release the guard before reaching the child, who ran straight on to the track and fell head foremost in front of the car. The coroner's jury returned a verdict of accidental death, and exonerated the driver from all blame.

### ROSSENDALE.

DEMAND FOR WAR BONUS FOR WOMEN AND BOYS.

About 100 employees of the Rawtenstall Corporation Tramways Department struck work on September 2 to enforce a demand that women and boys, like the men, should be paid a war bonus of 4s. per week, to date from July 1. The offer of the Corporation to women and youths was 2s. 6s. a week. The stoppage of the tramway service affected Bacup and neighbouring places, and special inconvenience was caused on September 3, which was a Rossendale holiday. On September 5 the strikers agreed to return to work on the understanding that their application would be considered by the Corporation.

### SOUTHAMPTON.

TRAMWAY EMPLOYEES AS GARDENERS.

The members of the Southampton Corporation Tramways Athletic and Social Club have devoted much time to the cultivation of gardens and allotments during this summer, and recently a show was held at the Portswood depot, at which there was a fine display of vegetables. This was the first event of the kind organised by the club, but it was thoroughly successful, and it is hoped that a similar show will be held each year. The movement was originated in order to encourage the many allotment holders among the tramway men, and the exhibits proved that the object had been fully attained. There were nearly 250 entries, and at the prize giving in the evening speeches were made by Alderman Dunsford, Mrs. Dunsford, Alderman Dacombe, Mr. W. T. Robson, the tramway manager, and others, in which warm appreciation was expressed of the good feeling existing between the employees and the management and committee. Many of the allotments cultivated by the exhibitors were originally dumping grounds for all kinds of rubbish, and the excellent result obtained is a striking testimony to the industry and persistence of the amateur gardeners. Provision was made for the encouragement of women conductors and boys, and it is interesting to note that one of the vegetable prize winners was a girl conductor, who had very successfully cultivated an allotment single-handed.

### WALLASEY.

A ONE-DAY STRIKE CAUSED BY FEAR OF WOMEN LABOUR.

The Wallasey Tramways Committee disagreed recently as to the advisability of employing women as drivers, and the Council gave a direct instruction that a few women should be trained and employed experimentally. When the manager attempted to carry out the instruction, a strike was threatened. It was pointed out to the men that the strike would be illegal under the Munitions of War Act, twenty-one days' notice being necessary to the Board of Trade, and even then if there was official intervention it would not be allowable for the men to carry out their threat. Colonel R. R. Greene, the tramways manager, attended a meeting of the employees, and explained that the resolution of the Council would have to be carried into effect, but although a few women were being trained, there was no intention of displacing men by the employment of woman labour. The employees nevertheless came out on strike, but returned to work on the following day on the understanding that the committee would give immediate attention to their grievances.

## MANCHESTER TRAMWAYS AND RATE RELIEF.

MANAGER'S RECOMMENDATION FOR INCREASED FARES.

In a special report presented to Manchester Tramways Committee by Mr. J. M. McElroy, the general manager, it is stated that the estimates on revenue account, prepared in April for the current financial year, showed, after meeting working expenses and fixed charges (but without provision for renewals), that a balance of £103,366 would be available. This sum the committee proposed to apportion as follows:—Renewals fund, £53,366; relief of rates, £50,000. In proposing to reduce the payment to the city fund from £100,000 to £50,000, the committee were satisfied that they were adopting a sound policy. When the estimates were before the Council a resolution was adopted that £100,000 should be contributed in relief of rates, and provision will therefore have to be made accordingly.

The revenue account from April 1 to June 30 last shows an increased income of £17,341, but the expenses are increasing as fast as the income. The net revenue shows an increase of £1,046 only. There will be a tendency for expenses to increase at a greater rate than income, and in the light of the figures now before him Mr. McElroy anticipates that at the end of the year, after making provision for payment of the £100,000 in relief of rates, there will be nothing available for the renewals fund. Indeed, there is a probability that there will be a deficiency.

Mr. McElroy adds that in previous reports he has pointed out the enormous drain which the war service allowances, war bonuses, etc., have been upon the financial resources of the undertaking. At the end of the current year the total amount which will have been paid under these heads since the outbreak of war will be about £350,000. The department has only been able to meet these payments by decreasing the amounts paid into the renewals fund. The total decreased provision up to the end of the current financial year will amount to £278,769. The renewals fund (less depreciation on investments) now stands at £320,528. This will be decreased during the year by payments for renewal purposes, and if there is a deficiency in the revenue account at the end of the year it will have to be made good by a transfer from the renewals fund. The renewals fund, as it now stands, is far from adequate. Immediately after the war a large amount of track renewals will be necessary, and in view of the high prices of materials the drain upon the fund will be very large.

The situation, the general manager says, is therefore serious, and demands prompt action on the part of the committee. The only possible action lies in the direction of increasing the fares—a course which Mr. McElroy recommends the committee to adopt.

## PATENT LIST.

### Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

### APPLICATIONS FOR LETTERS PATENT.

Fare-ticket systems and devices, etc. (12,567)—W. Aitken.
Trolley wheels (12,412)—A. E. Alexander (*Ollard Trolley Wheel Company*).
Compensating driving mechanism for motor vehicles (12,411)—J. D. Allen.
Brake blocks and linings, clutch linings, etc. (12,310)—H. Frood.
Substitute for petrol for motive power (12,530)—H. Iredell.
Storage systems for supply of gas to internal combustion engines (12,542)—London General Omnibus Company.
Means of manipulating trolley poles of electric vehicles (12,819)—J. L. Carr.
Motor vehicles (12,639)—L. S. Girling.
Apparatus for storing coal gas, etc., for use in motor vehicles (12,722)—G. P. Ottino.
Tram rail (12,743)—W. H. Puttergill.
Electro-pneumatic braking systems (12,724 and 12,727)—W. V. Turner.
Fluid-pressure braking apparatus (12,725 and 12,726)—W. V. Turner.
Lifeguards for tramway, etc., vehicles (12,759)—H. Worsnop, J. Worsnop, and M. Worsnop.
Devices for preventing creeping of rails (13,222)—Akt.-Ges. der Eisen-und Stahlwerke vorm. G. Fischer.
Anti-friction rail wheels (13,134)—H. N. Barnes and E. Pollard and Company.
Gas containers for motor vehicle propulsion (13,232)—G. E. Duerden.
Gas containers for motor vehicles (13,229)—R. C. Jagger.
Supporting and carrying gas bags or containers for motor vehicles (13,161)—A. Moore and J. D. Tomlinson.
Transmission gear for self-propelled vehicles (13,121)—G. R. Rankine.
Overhead trollies for electric tramway or railway vehicles (13,057)—E. Spencer.

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In the United Kingdom—Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).
One Shilling per Single Copy. (Postage 2d.)
For Places Abroad—Thirty Shillings per annum.

Portable gasometer for use with motor vehicles (13,001)—F. Spivey.
Means for storing and supplying gas for motor vehicles (13,518)—H. and W. Broughton.
Trolley-wire systems for electric railways, tramways, etc. (13,551)—P. Dawson and F. W. Fawdry.
Electric tramway trolley wire finder and trolley wheel adjuster (13,358)—D. A. Halpin and R. Lancaster.
Collapsible gas holders for motor vehicles (13,641)—J. C. Jolly and United Automobile Services, Limited.
Motor vehicles (13,489)—London and Westminster Industrial Syndicate and H. B. Molesworth.
Gas equipments for motor vehicles (13,642)—R. Oldham and Whitehouse and Oldham.
Sleepers for railways, etc. (13,530)—E. A. W. Phillips.
Control of transmission mechanism for heavy mechanically-propelled vehicles (13,611)—W. G. Wilson.
Heavy mechanically-propelled road vehicles (13,612)—W. G. Wilson.
Gas containers for motor vehicles (13,269)—H. O. Worrall.
Liquid fuel feeding devices for motor vehicles (13,702)—T. Blakey.
Automatic folders for gas containers on gas-driven vehicles (14,101)—G. and W. Chapman.
Supporting device for overhead electric trolley wires (13,726)—P. Dawson, F. W. Fawdry, and H. W. H. Richards.
Method of imparting elasticity to railway sleepers of reinforced concrete (13,711)—A. Wood-Hill.
Elevated railways, tramways, etc. (14,017)—S. A. Rogers.
Electrical transmission arrangements for motor vehicles, etc. (13,741)—J. Sankey and Sons and W. A. Stevens.

## Specifications Published.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application number should, however, still be used for correspondence purposes

Steering mechanism for motor vehicles (13,570—*108,389*)—G. C. Hayes and C. C. D. Steele.
Reinforced concrete railway sleepers and means for fixing rails and chairs thereto (15,143—*102,050*)—L. Pelnard-Considere.
Tires (10,575—*109,070*)—Dunlop Rubber Company and C. Macbeth.
Tires (12,155—*109,082*)—J. H. Christian.
Trolley poles for electric cars (12,316—*109,098*)—T. Warsop.
Motor road vehicles (14,934—*109,139*)—H. U. Diplock.
Motor vehicles (16,019—*108,970*)—Daimler Company and F. W. Lanchester.

1917.

Regenerative braking systems (2,872—*105,225*)—W. V. Turner.
Lifting jacks for use on motor road vehicles (4,182—*108,822*)—F. L. Rapson.
Securing flanged railway rails to metal sleepers (6,540—*108,834*)—W. H. Ashmore.
Rail joints (5,131—*809,222*)—J. Zahuranec.

## Colonial and Foreign Tramways Traffic Returns.

| NAME OF COMPANY. | 1916. WEEKS ENDED. Sept. 2. | Sept. 9. | Sept. 16. | Sept. 23. | Sept. 30. | 1917. WEEKS ENDED. Sept. 1. | Sept. 8. | Sept. 15. | Sept. 22. | Sept. 29. | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Anglo-Argentine ... ... ... | 47,933 | 52,818 | 51,992 | 50,087 | 50,947 | 50,116 | 53,759 | 53,807 | 53,200 | 53,126 | 39 | 2,002,660 | + 24,827 |
| Auckland ... ... ... .. ... | ... | ... | (28 days) | 20,884 | ... | ... | ... | (28 days) | 22,154 | ... | 12 | 64,876 | + 2,018 |
| Calcutta ... ... ... ... Rs. | 65,007 | 72,433 | 73,566 | 69,737 | 72,605 | 69,550 | 71,115 | 72,540 | 70,885 | 72,180 | 39 | 2,662,235 | + 22,369 |
| Madras ... ... ... ... Rs. | 34,066 | (2 weeks) | 34,552 | (2 weeks) | 31,788 | 39,031 | (2 weeks) | 36,217 | (2 weeks) | 34,219 | 39 | 624,412 | + 54,626 |
| Pernambuco ... ... ... .. | 3,148 | 3,437 | 3,181 | 3,147 | 3,094 | 4,013 | 3,804 | 3,787 | 3,845 | 4,061 | 38 | 146,072 | + 28,504 |

## Companies Issuing Monthly Statements.

| | 1916. April. | May. | June. | July. | August. | Sept. | 1917. April. | May. | June. | July. | August. | Sept. | Wks. | AGGREGATE. 1917. | + or −. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Ballarat & Bendigo .. | 3.727 | 3.854 | 2.794 | 2.704 | ... | ... | 4.611 | 2.991 | 2.849 | 2.593 | ... | ... | 16 | 13.044 | − 35 |
| Brazilian Traction Mlrs | 6882000 | 7304000 | 7178000 | 7429000 | 7405000 | ... | 7453000 | 7864000 | 7642000 | 7795000 | 8064000 | ... | 34 | 60,505.000 | +4.492.000 |
| Brisbane ... ... ... | 32.575 | 33.150 | 31.390 | 32.880 | 37.900 | 32,530 | 31.620 | 33.340 | 32.475 | 32.720 | 36.925 | 31,600 | 39 | 294.840 | − 2.820 |
| British Columbia $ | 421.265 | 414.215 | 400.814 | 411.847 | 423.738 | ... | 447.429 | 438.919 | 373.029 | 438.378 | 454,425 | ... | 8 | 892.803 | + 57,218 |
| Buenos Ayres Lacroze | 40.220 | 40.220 | 36.213 | 38.439 | 36.431 | ... | 39.111 | 40.595 | 38.020 | 38.063 | 39.111 | ... | 8 | 77.174 | + 2.304 |
| Burma ... ... ... | 22,191 | 23,585 | 24,027 | 26.340 | 24.413 | ... | 23.660 | 24.906 | 25.463 | 26.288 | 26.714 | ... | 4 | 26,714 | + 2.301 |
| Cape Town ... ... | ... | ... | ... | ... | ... | ... | 16.705 | 15.867 | ... | 16.067 | 15.480 | ... | 8 | 31.547 | + 4.796 |
| Carthagena & Herrerias | 2.513 | 2.927 | 3.512 | 2.371 | 2.081 | 1.779 | 4.366 | 4.321 | 5.325 | 5.763 | 4.164 | 4.306 | 39 | 38.405 | + 15.805 |
| Cordoba ... .. ... | ... | 14.869 | 14.120 | 14.258 | ... | ... | ... | 13.735 | 14.416 | 14.343 | ... | ... | 18 | 56.154 | − 1.165 |
| East India ... ... | 2.116 | 2.161 | 2.283 | 2,220 | 2.522 | 2.523 | 1.445 | 1.455 | 1.186 | 1.183 | 1.562 | 1,512 | 9 | 3.074 | − 1.971 |
| Kalgoorlie ... ... | 2.553 | 2.921 | 2.500 | ... | ... | ... | 2,705 | 2.692 | 2.648 | ... | ... | ... | 26 | 15,441 | + 504 |
| La Plata ... .. ... | 4.354 | 4.342 | 3,735 | 3.910 | 3.793 | 3.993 | 4.229 | 4.126 | 3.852 | 3,875 | 4.076 | 3.450 | 39 | 36.545 | − 1.076 |
| Lima ... ... ... | 33.542 | 33.966 | ... | ... | ... | ... | 37.807 | 35.321 | ... | ... | ... | ... | 21 | 181.809 | + 13.098 |
| Manaos ... ... Rs. | 155.030 | 152.854 | 144.913 | 152.380 | ... | ... | 160.545 | 158.613 | 165.693 | 162.157 | ... | ... | — | — | — |
| Manila ... ... $ | ... | 53,900 | 59,432 | ... | ... | ... | ... | 61.500 | 73.900 | ... | ... | ... | — | — | — |
| Mexico ... ... $ | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Monte Video ... ... | 28.997 | 28.349 | 25.300 | 25.220 | 26.044 | 26.711 | 29.230 | 28.716 | 27.458 | 28.597 | 28.860 | 29.426 | 48 | 329.679 | + 10.636 |
| Peruvian ... ... $ | ... | 826.900 | 929,500 | 835.430 | 895.900 | 911.910 | ... | 902.780 | 965,420 | 975.000 | 979.430 | 950.740 | 13 | 2.905.170 | + 261.930 |
| Port Elizabeth ... ... | ... | ... | ... | 3.166 | 2.863 | ... | 3.904 | 3.494 | ... | 3.544 | 3.360 | ... | 8 | 6.904 | + 875 |
| Rangoon ... ... ... | 4.849 | 4.589 | 4.205 | 4.357 | 4.253 | 4.137 | 5.036 | 4.737 | 4.383 | 4.783 | 4.788 | 5.163 | 39 | 44.354 | + 3.026 |
| Toronto ... ... $ | 883.209 | 903.924 | 884.491 | 867.789 | 889.241 | ... | 970.367 | 992.460 | 984.529 | 954.192 | 1039819 | ... | 34 | 7.867.595 | + 775.366 |
| Winnipeg ... $ | 282.498 | 276.980 | 254.686 | 242.688 | 249.795 | ... | 265,594 | 259,794 | 254.226 | 242.797 | 248.457 | ... | 34 | 2.164.624 | − 29.333 |

(*Continued on page 276*)

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# TRAFFIC RETURNS—*continued.*

## Tramways and Omnibus Undertakings in the United Kingdom.

| NAME OF COMPANY OR CORPORATION. | 1916. WEEKS ENDED. | | | | | 1917. WEEKS ENDED. | | | | | AGGREGATE. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sept. 2. | Sept. 9. | Sept. 16. | Sept. 23. | Sept. 30. | Sept. 1. | Sept. 8. | Sept. 15. | Sept. 22. | Sept. 29 | Wks. | 1917. | Increase or Decrease. |
| | £ | £ | £ | £ | | £ | £ | £ | £ | | | £ | £ |
| Aberdare U.D. Council ... ... | 411 | 407 | 407 | 407 | 430 | 423 | 435 | 449 | 456 | 441 | 25 | 11.210 | + 1.025 |
| Aberdeen Corporation ... ... | 2.005 | 2.252 | 2.041 | 1.854 | 2.025 | 2.206 | 2.401 | 2.205 | 2.178 | 2.216 | 17 | 38.190 | + 4.433 |
| Accrington Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ayr Corporation ... ... ... | 638 | 575 | 474 | 376 | 438 | 535 | 456 | 447 | 421 | 526 | 20 | 11.629 | + 918 |
| Bath Electric ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Belfast City ... ... ... ... | 5.840 | 5.844 | 5.882 | 5.588 | 5.883 | 6.330 | 6.820 | 6.928 | 6.730 | 6.609 | 26 | 163.349 | + 15.774 |
| Birkenhead Corporation ... ... | 1.617 | 1.577 | 1.555 | 1.610 | 1.671 | 1.897 | 2.263 | 2.003 | 1.903 | 1.982 | 26½ | 48.471 | + 7.490 |
| Birmingham Corporation ... ... | 16.789 | 16.855 | 16.700 | 16.388 | 18.117 | 18.099 | 19.109 | 19.153 | 19.206 | 19.429 | 26 | 470.497 | + 36.147 |
| Birmingham Corp. Motor Omnibuses | 1.001 | 1.043 | 979 | 960 | 1.078 | 1.023 | 1.211 | 1.213 | 1.187 | 1.204 | 26 | 26.218 | — 118 |
| Blackburn Corporation ... ... | 1.305 | 1.323 | 1.417 | 1.375 | 1.385 | 1.392 | 1.521 | 1.778 | 1.788 | 1 493 | 26½ | 40.836 | + 5.916 |
| Blackpool and Fleetwood ... ... | 2.352 | 2.247 | 1.631 | 1.268 | ... | 1.939 | 2.299 | 1.686 | 1.535 | ... | 37 | 36.324 | — 128 |
| Blackpool Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bolton Corporation ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bournemouth Corporation ... ... | 3.108 | 2.998 | 2 619 | 2.431 | 2.337 | 3.449 | 3.366 | 2.825 | 2.985 | 2.973 | 26½ | 71.648 | — 4.778 |
| Bradford Corporation ... ... | 8.136 | 7.045 | 7.497 | 6.572 | 7,078 | 7.446 | 8.396 | 8.032 | 7.603 | 7.940 | 26 | 202.664 | — 18 091 |
| Brighton Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bristol ... ... ... ... | 5.431 | 5.372 | 5.405 | 5.162 | 5.419 | 5.664 | 6.377 | 6.134 | 6.170 | 6.123 | 39 | 211.363 | + 19.403 |
| Burnley Corporation... ... ... | 1.818 | 2.008 | 1.850 | 1.738 | 1.765 | 1.750 | 2.221 | 2.224 | 1.927 | 1.966 | — | — | — |
| Burton-on-Trent Corporation ... | 302 | 295 | 287 | 290 | 293 | 341 | 327 | 326 | 340 | 329 | 26 | 8.046 | + 734 |
| Bury Corporation ... ... ... | 1.491 | 1.579 | 1.449 | 1.533 | 1.726 | 1,568 | 1.977 | 1.736 | 1.683 | 1.738 | 26½ | 44.839 | + 5 291 |
| Cardiff Corporation ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Chatham and District ... ... | 1.486 | 1.410 | 1.420 | 1.378 | 1.381 | 1.429 | 1.530 | 1.429 | 1.395 | 1.299 | 39 | 50.872 | + 2.687 |
| Chesterfield Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Colne Corporation ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Cork Electric ... ... ... ... | 557 | 598 | 583 | 527 | 542 | 577 | 636 | 626 | 611 | 598 | 39 | 21.362 | + 1.377 |
| Croydon Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Derby Corporation ... ... ... | 1.211 | 1.185 | 1.142 | 1.120 | 1.163 | 1.251 | 1.272 | 1.245 | 1.254 | 1.259 | 26 | 31.667 | + 1.158 |
| Dover Corporation ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin and Lucan ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin United ... ... ... | 6.831 | 6.739 | 6.803 | 6.269 | 6.682 | 6.790 | 7.393 | 7.269 | 7.368 | 7.040 | 39 | 260.814 | + 25.530 |
| Dundee City ... ... ... ... | 1.458 | 1.493 | 1.639 | 1.387 | 1.393 | 1.625 | 1.696 | 1.512 | 1.598 | 1.576 | 19½ | 30.192 | + 2.736 |
| East Ham Corporation ... ... | 1.322 | 1.329 | 1.335 | 1.314 | 1.398 | 1.484 | 1.480 | 1.471 | 1.497 | 1 324 | 26 | 37.569 | + 2.562 |
| Exeter Corporation ... ... | 478 | 472 | 454 | 439 | 445 | 436 | 469 | 453 | 447 | 433 | 26 | 10.860 | — 33 |
| Gearless Motor 'Buses ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Glasgow Corporation ... ... | 23.552 | 23 809 | 24.085 | 23.450 | 24.543 | 26.153 | 27.170 | 27.615 | 27.124 | 27.394 | 17½ | 458.164 | + 54.059 |
| Glossop (Urban Elec. Supply Co.)... | 153 | 153 | 151 | 150 | 162 | 171 | 187 | 186 | 183 | 178 | 39 | 5.913 | + 495 |
| Halifax Corporation ... ... ... | 2.702 | 2.545 | 2.412 | 2.192 | 2.341 | 2.474 | 2.757 | 2 817 | 2.558 | 2.431 | 25½ | 65.962 | + 5.019 |
| Halifax Corp. Motor Omnibuses ... | 52 | 53 | 52 | 51 | 52 | 51 | 52 | 55 | 54 | 54 | 25½ | 1.239 | — 66 |
| Hastings and District ... ... | 1.646 | 1.734 | 1.552 | 1.329 | 1.267 | 1.791 | 1.956 | 1.819 | 1.553 | 1.609 | 39 | 49.702 | + 7.387 |
| Huddersfield Corporation ... ... | 3.015 | 3.569 | 2.849 | 2.805 | 3.117 | 3.131 | 4.578 | 3.219 | 3 210 | 3 450 | 26 | 87.403 | + 7.827 |
| Hull Corporation ... ... ... | 3,168 | 3.067 | 3.106 | 3.028 | 2.979 | 3.543 | 3.566 | 3 483 | 3.547 | 3 559 | 26 | 88.862 | + 6.652 |
| Ilford U.D. Council ... ... ... | 680 | 697 | 695 | 682 | 689 | 817 | 838 | 809 | 835 | 739 | 26 | 20.578 | + 2.164 |
| Ilkeston Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ipswich Corporation ... ... | 595 | 560 | 560 | 518 | 561 | 817 | 860 | 793 | 787 | 726 | 26 | 18.718 | + 4.038 |
| Isle of Thanet ... ... ... | 797 | 752 | 642 | 494 | 436 | 469 | 448 | 373 | 309 | 240 | 52 | 16.317 | — 3.459 |
| Kilmarnock Corporation ... ... | 184 | 182 | 182 | 177 | 181 | 201 | 217 | 205 | 204 | 207 | 19½ | 3 871 | + 326 |
| Lanarkshire ... ... ... ... | 2.442 | 2.500 | 2.586 | 2.491 | 2.659 | 2.994 | 3.007 | 3.066 | 3.124 | 3.177 | 39 | 107.118 | + 16 840 |
| Lancashire United ... ... ... | 2.014 | 2.205 | 2.020 | 1.898 | 2.189 | 2.579 | 3.152 | 2.966 | 2.605 | 2.335 | 39 | 90.910 | + 20.075 |
| Leeds City ... ... ... ... | 10.534 | 10,075 | 9.823 | 9.990 | 10.310 | 10.767 | 11.790 | 11.579 | 11.232 | 11.326 | 26 | 290.088 | + 29.329 |
| Leicester Corporation ... ... | ... | ... | 3.396 | 3.370 | 3.794 | ... | ... | 3.937 | 4.011 | 3.941 | — | — | — |
| Leith Corporation ... ... ... | 932 | 913 | 914 | 855 | 909 | 1.055 | 1.119 | 1.129 | 1.131 | 1.113 | 19½ | 21.604 | + 3.820 |
| Leyton U.D. Council ... ... | 1.732 | 1.771 | 1.787 | 1.771 | 1.889 | 1.964 | 2.032 | 1.927 | 1.996 | 1.900 | 26 | 50 448 | + 5 228 |
| Liverpool Corporation ... ... | 14.964 | 14.662 | 14.367 | 14.219 | 15.079 | 15.884 | 16.920 | 16.757 | 16.369 | 16 290 | 38½ | 601.540 | + 53.155 |
| Llandudno and Colwyn Bay ... | 836 | 781 | 636 | 546 | 460 | 739 | 723 | 610 | 560 | 450 | 43½ | 15.603 | — 971 |
| London County Council ... ... | 49.502 | 49.247 | 49.461 | 49.349 | 51.640 | 57.679 | 59.227 | 57.506 | 58.787 | 57.800 | 25½ | 1,437.272 | + 185.481 |
| London General Omnibus ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| London United ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Lowestoft Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Maidstone Corporation ... ... | 240 | 247 | 256 | 243 | 248 | 253 | 282 | 284 | 295 | 269 | 26 | 6.565 | + 638 |
| Manchester Corporation ... ... | 19.468 | 19.099 | 18.597 | 18.501 | 19.765 | 20.409 | 21.693 | 21.498 | 21.118 | 21.274 | 26 | 537.327 | + 39.898 |
| Metropolitan Electric Tramways ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| National Steam Car ... ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Nelson Corporation ... ... ... | 242 | 235 | 239 | 209 | 237 | 233 | 273 | 310 | 221 | 253 | 26 | 6.244 | + 443 |
| Newcastle-on-Tyne Corporation ... | 6.517 | 6.373 | 7.005 | 7.027 | 7.117 | 7.810 | 8.156 | 8.208 | 8.150 | 8.142 | 26 | 203.370 | — 29.640 |
| Newport (Mon.) Corporation ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| New St. Helens and District ... | 1.132 | 1.187 | 1.130 | 1.000 | 1.111 | 1.459 | 1.631 | 1.681 | 1.468 | 1.343 | 13 | 21.086 | 5.931 |
| Northampton Corporation ... ... | 759 | 733 | 725 | 731 | 731 | 834 | 895 | 896 | 913 | 986 | 26 | 21.820 | + 3 033 |
| Nottingham Corporation ... ... | 4.191 | 4.187 | 4,063 | 4.084 | 4.592 | 4,548 | 4.603 | 4.671 | 4.693 | 4.592 | 26 | 113 938 | — 10 554 |
| Oldham Corporation ... ... | 2.636 | 2.504 | 2.414 | 2.512 | 2.498 | 2.969 | 3.049 | 2.908 | 2.770 | 2 948 | 27 | 77.835 | + 8 504 |
| Portsmouth Corporation ... ... | 3.291 | 3.320 | 3 370 | 2.839 | 2.884 | 3.137 | 3.675 | 3.601 | 3.123 | 3,282 | — | — | — |
| Preston Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Provincial ... ... ... ... | 2.885 | 2.894 | 2.951 | 2.547 | 2.591 | 2.681 | 3.162 | 2.967 | 2.657 | 2.813 | 52 | 122.038 | + 1.379 |
| Reading Corporation ... ... | 957 | 975 | 983 | 909 | 924 | 1.114 | 1.163 | 1.152 | 1.111 | 1.132 | 25½ | 27.199 | + 4.602 |
| Rhondda Tramways ... ... | 1.399 | 1.488 | 1.449 | 1.412 | 1.409 | 1.541 | 1.626 | 1.659 | 1.661 | 1.630 | 39 | 57.942 | + 8.128 |
| Rochdale Corporation ... ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Rotherham Corporation ... ... | 1.678 | 1.657 | 1.682 | 1.789 | 1.625 | 1.837 | 1.858 | 1.870 | 1.895 | 1.906 | 26½ | 47.807 | + 6.410 |
| Salford Corporation ... ... ... | 5.489 | 5.607 | 5.369 | 5.611 | 5 800 | 6.663 | 7.026 | 6,727 | 6.448 | 6.896 | 26½ | 175 638 | + 27.927 |
| Sheffield Corporation ... ... | 10.702 | 10.599 | 10.812 | 10.752 | 11.505 | 12.141 | 12.573 | 12.586 | 12.236 | 12.672 | 27 | 323 012 | — 36 803 |
| Southampton Corporation ... ... | 1.828 | 1.916 | 1.900 | 1.737 | 1.721 | 2.114 | 2.341 | 2.310 | 2.165 | 2.243 | 25½ | 52.217 | — 8 233 |
| Southend-on-Sea Corporation ... | ... | 1.350 | 1.225 | 1.054 | ... | ... | 1.186 | 999 | 916 | ... | 25 | 26.825 | + 94 |
| South Metropolitan Tramways ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| South Shields Corporation ... ... | 971 | 892 | 869 | 864 | ... | 985 | 1.017 | 985 | 990 | ... | 25 | 24,226 | + 2.800 |
| Sunderland Corporation ... ... | 1.732 | 1.872 | 1.638 | 1.679 | 1.603 | 1.827 | 1.969 | 1.912 | 1.859 | 1.851 | 26 | 47.939 | + 4.040 |
| Sunderland District ... ... ... | 685 | 724 | 714 | 640 | 698 | 758 | 792 | 794 | 807 | 775 | 48 | 34.300 | + 4 846 |
| Swindon Corporation ... ... | 236 | 240 | 225 | 222 | 220 | 273 | 302 | 293 | 294 | 288 | 25½ | 7.101 | + 1.723 |
| Torquay Tramways ... ... ... | 955 | 985 | 976 | 826 | 742 | 915 | 1.117 | 1.061 | 892 | 900 | 39 | 25 810 | + 1.860 |
| Tramways (M.E.T.) Omnibus Co... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Tyneside Tramways and Tramroads | 708 | 715 | 708 | 654 | ... | 939 | 947 | 974 | 955 | ... | 12 | 11.536 | + 2.887 |
| Wallasey Corporation ... ... | 1.627 | 1.596 | 1,442 | 1.352 | 1.435 | 1.809 | 1.898 | 1.611 | 1.608 | 1.563 | 26½ | 43 347 | + 4.900 |
| Walsall Corporation ... ... ... | 876 | 838 | 819 | 848 | 869 | 971 | 1.006 | 1.010 | 1.062 | 999 | 26 | 25 398 | + 3 101 |
| Walthamstow U.D. Council ... | 1.102 | 1.184 | 1.180 | 1.152 | 1.308 | 1.264 | 1.364 | 1.310 | 1.362 | 1.218 | 26 | 33 799 | + 3 635 |
| Warrington Corporation ... ... | 520 | 515 | 506 | 506 | 534 | 566 | 577 | 570 | 584 | 590 | 26 | 13 899 | + 1.070 |
| West Ham Corporation ... ... | 3.152 | 3.184 | 3.268 | 3.243 | 3.666 | 3.778 | 3.924 | 3.772 | 3.913 | 3.744 | 25½ | 96 715 | + 11 079 |
| Wigan Corporation ... ... ... | 1.694 | 1,716 | 1.766 | 1.733 | 1.781 | 1.993 | 2.036 | 2.067 | 2.048 | 2.003 | 26 | 50.912 | + 6 830 |
| Wolverhampton Corporation ... | * | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Yorkshire (West Riding) ... ... | 1.898 | 1.912 | 1.806 | 1.894 | 1.915 | 2.424 | 2.437 | 2.260 | 2.209 | 2.261 | 39 | 82.566 | + 13.849 |

### * TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

### TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.


### THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates:

For the United Kingdom—
Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).

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¶ Daimler Commercial Vehicles have been delivered in great numbers to the War Department.

¶ After the war the majority of drivers will be *au fait* with the famous Daimler Sleeve-Valve Engine.

¶ Their experiences under hard-working conditions will add further testimony to the superiority of the Daimler Product.

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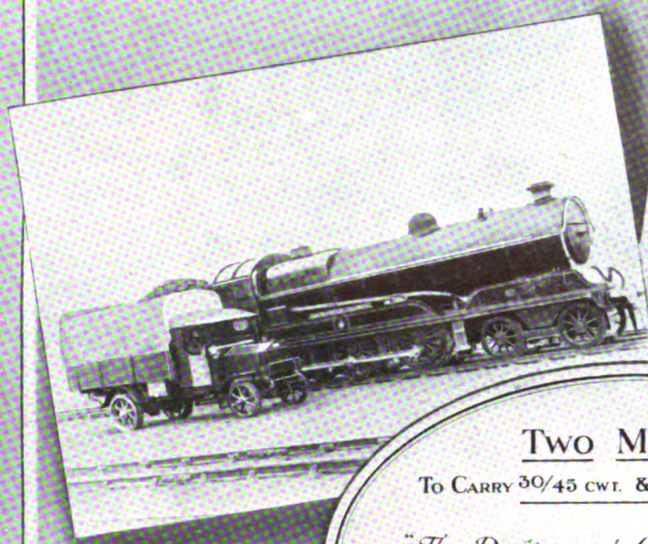
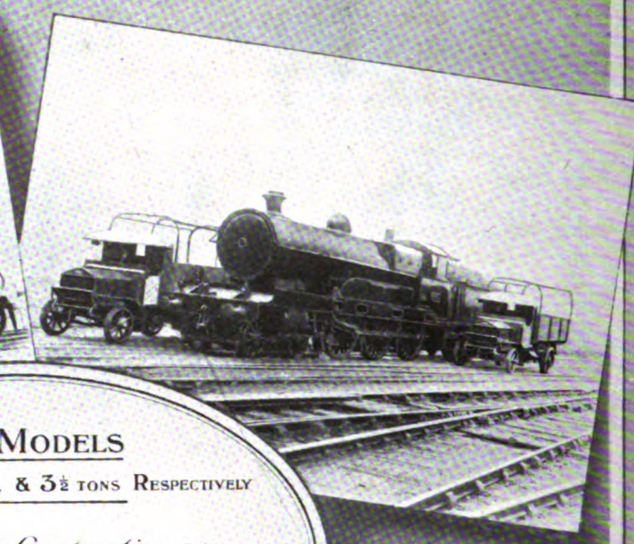
# NAPIER

## MOTOR VEHICLES.





TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

*"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."*

*RAILWAY GAZETTE, MARCH 31, 1916.*

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USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

**IN WAR**

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

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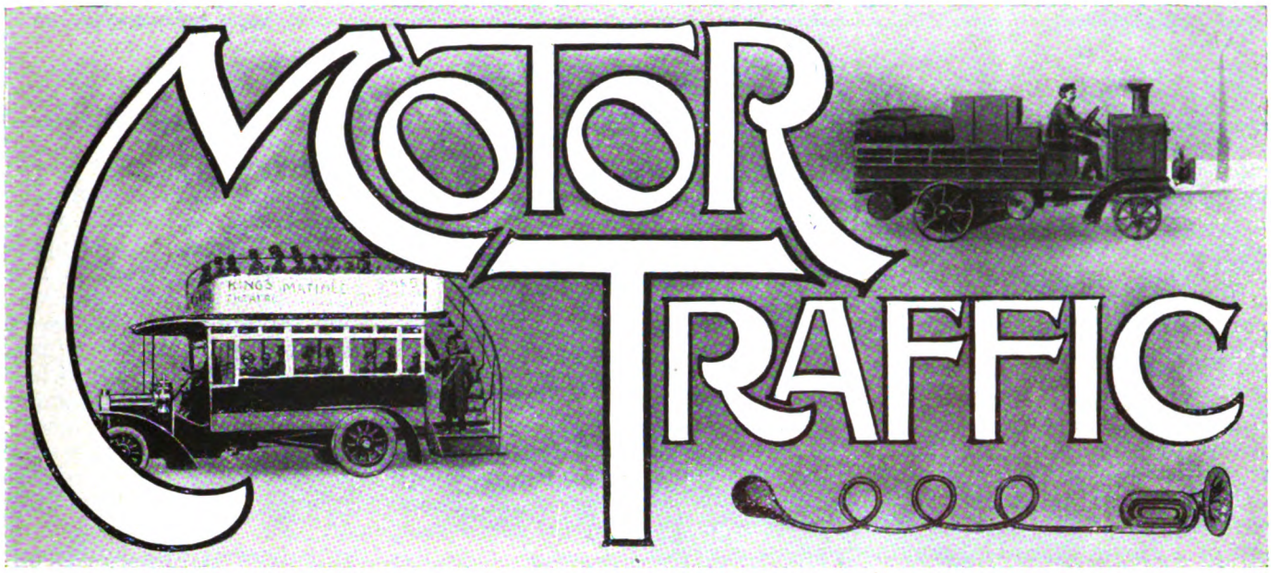


We learn that what may, perhaps, be described as a semi-official suggestion has been made to municipalities to the effect that they will have to look beyond petrol or coal in order to find the fuel of the immediate future for their motor vehicles. From this it is deduced that their attention must necessarily be turned to the electric vehicle. The alternative of the steam lorry is ruled out, not because of shortage of suitable fuel, but rather because the output of the manufacturers is required for other purposes. Consequently, the charging of vehicle batteries from electric mains drawing their supply originally from coal is not inadmissible. At the same time, there is no real justification for any suggestion to the effect that the electric vehicle is the only possible solution of the present difficulty. The progress that has been made in the use of coal gas has lately been so rapid as to negative this contention in a very satisfactory manner.

* * * * * *

Admittedly, in many forms of municipal work the electric vehicle has excellent opportunities. Thus, for example, in the transport of refuse and the work of street cleaning, much of which has to be done in the small hours of the morning, silence in running is a factor of distinct importance. Moreover, the electric method lends itself to traffic work, since it eliminates change speed gears and thus renders possible very steady acceleration and retardation. Weight is of course against electric batteries and so is their somewhat limited radius of action, but in many municipal services, including those concerned with the local carriage of passengers, the latter drawback is of practically no importance. Arrangements can easily be effected by which discharged batteries can be removed, and replaced by others fully charged, in a very few minutes at the terminal points of the service. Moreover, partially discharged batteries can be "boosted" up at a high rate during the comparatively short intervals required for the driver's meals. It is, however, a mistake under present circumstances to advocate the electric method of propulsion by encouraging municipalities to adopt it, not so much on account of its intrinsic advantages as upon the assumption that it is the only thing to do. Even in its present elementary form, the disadvantages attaching to the use of coal gas are in the main something like those that face the electric system. In other words, the carriage of the source of power is inconvenient and the radius of action is limited. Coal gas, being capable of use either approximately at atmospheric pressure or when compressed to a considerable degree, offers, in respect of its containers, a choice between weight and bulk. Therefore, where weight is a drawback and bulk is not, it has a decided advantage over electricity. As regards recharging, coal gas has certain advantages over electricity. In the former case, the work only takes a few minutes; in the latter, the time occupied must be measured in hours. So far as radius of action is concerned, the case is much the same in the two instances. In other words, we have to compromise between carrying dead weight or inconveniently bulky containers on the one hand, or a strictly limited length of journey on the other.

* * * * * *

It will probably turn out that the report of the British Commercial Gas Association published in our last issue presented a very conservative statement of the case for coal gas, basing conclusions on the limited knowledge available at an extremely early stage in the movement. It is possible, and indeed probable, that the whole structure of the report, based as it is on the theory that pressures much in excess of 25 atmospheres are not practical, will be found to be faulty. There are already signs to the effect that this pressure will be considerably exceeded, in which case the consequence will be to make it possible to carry larger stocks of fuel with a smaller increase of dead weight. Moreover, the account did not anticipate any such improvements as are suggested by the possibility of storing the gas in absorbent materials, and so increasing the effective capacity of the containers without materially increasing their weight or dimensions.

* * * * * *

We are only at the beginning of investigations into the possibility of coal gas, and the end should not be rashly prejudged. But coal gas has the great advantage that it can be used on any existing vehicle intended to burn petrol. While new petrol vehicles are difficult to obtain, this is equally true of electric vehicles, and there are at present infinitely more of the former than of the latter in service. We do not disagree with the advice given to municipalities to consider the electric system, but we feel strongly that such advice ought to have been coupled with the suggestion that they should also consider the possibility of using coal gas on their existing petrol vehicles. It happens that at the present moment there is nothing to be said against the consumption of coal gas, and in fact there are urgent reasons which favour the encouragement of a demand for this fuel. The same cannot be said of any other

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# MOTOR TRAFFIC.

source of power, the creation of which demands the consumption of coal for that specific purpose alone. Our coal supplies need conserving with all possible economy, and the justification for employing coal in the creation of coal gas lies, not so much in the need for that product itself, as in the need for other products simultaneously brought into existence and urgently required for war purposes.

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In our last issue we referred to the relations existing between taxicab drivers and operating companies, and the underlying causes that have influenced the establishment of those relations. It will be interesting to note the consequences of the latest development in the form of a Home Office Order authoris ng an increase in London cab fares. The drivers have always been opposed to this, for the simple reason that the minimum fare of eightpence generally means the payment of a shilling, out of which the driver gets fourpence as a tip as well as his share of the amount registered on the meter. An increase in the minimum payment up to a shilling for the first mile would, as the drivers maintain, often mean an identical payment by the fare, but a redistribution so far as the driver and his employer are concerned, a larger sum being registered on the clock and a smaller going direct into the pocket of the driver. Thus, the mere chance that the rate originally fixed encourages a fairly liberal tip has been the means of preventing a much-needed increase from being legalised for a very long time past. It does not seem that the drivers have yet realised what the real choice before them is, namely, that the companies cannot go on upon the old basis and must either charge more or cease work altogether. On a straight issue, the owner-driver ought to welcome the increase, but perhaps he may take a long-headed view and conclude that the best thing for him is to see the companies' cabs taken off the road altogether, and then—but not till then—demand an increase in fares. On the whole, this new development is merely another reason for taking the view that we have already expressed, namely, that the future lies with the owner-driver and not with the company or its men.

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Attention is again drawn to the possibilities of alcohol fuel by the publication of the first report of the Special Committee of the Commonwealth Advisory Council of Science and Industry, which has its headquarters at Melbourne. Australia annually wastes enough molasses to produce some three million gallons of alcohol. There are also infinite possibilities of growing alcohol crops on cheap land, and so producing the spirit in quantities and at a price rendering it capable of filling the great bulk of the liquid fuel demand of Australia. The Commonwealth Government is therefore the first within the British Empire to take up this matter officially. It is to be hoped that enough funds will be made available to allow it to be carried through to a finish. The Committee finds it necessary first of all to educate public opinion, and this it intends to do by exhibiting specially-designed alcohol engines at work at agricultural shows and elsewhere. It will endeavour to popularise first the use of the slow-speed high compression stationary engine of the type that will consume alcohol with a high degree of efficiency. A rather secondary place in its programme is given to the work of popularising the use of alcohol as part of a mixture with some other fuel in the engines of motor vehicles. The main reason for this general line of action lies in the difficulty of perfecting a complete system of distribution for a new class of motor fuel. The system built up by the petrol importers is a very fine and complete one, and it is difficult to see how a competitive fuel, unless supported by an equally extensive system of distribution, can be made to hold its own. The Australian Committee has therefore decided that, in popularising the stationary alcohol engine, it is working along the line of least resistance and is inaugurating a movement which, when carried to success, will undoubtedly bring in its train the other and greater development. The whole subject is of immediate importance to us here, principally because if Australia makes its own liquid fuel, it will cease to be a market for petrol and will consequently help to reduce a demand which bids fair to outstrip supply and to drive and keep up the price to an abnormal figure.

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## ELECTRIC TOWER WAGON COSTS.

In view of the curtailment of petrol supplies, Mr. T. W. Bloxam, city electrical engineer of Belfast, has prepared the following report upon the use of electric vehicles during the past two and a quarter years :—

" In May, 1915, we commenced using a wagon with Edison battery in place of a petrol-driven wagon for the repair of the overhead equipment. The vehicle has enabled the department to effect very material saving in the cost of this work, where facility for starting, stopping, and manœuvring in traffic more than counterbalances any loss of time on the road, unless the journey is to a distant part.

" Comparing the running costs per mile with the petrol vehicle, our records give us the following figures :—During the two and a quarter years ended July, 1917, the electric ran 7,398 miles and used 6,651 units of electricity, or ·89 unit per mile. The petrol vehicle ran 5,800 miles and used 1,621 gallons petrol, or ·28 gallon per mile.

" The cost of electricity to tramways for year ended March, 1917, was 1·137 pence per unit. The average price of petrol over the year was 2s. 3¾d. per gallon. Therefore during the year to March, 1917, the electric cost 1·01d. per mile for electricity, and the petrol wagon cost 7·77d. per mile for petrol—a saving of 6½d. per mile, or approximately £70 per annum, by using electricity.

" The repairs required by the electric are substantially less than those for a petrol vehicle. The only repair was the result of an accident in April, 1916, which necessitated rewinding the armature of the motor ; since that date the vehicle has only required to be thoroughly cleaned and repainted.

"As regards commercial electric vehicles generally, certain firms in the city have for some time realised the considerable saving that can be effected by their use compared with the petrol vehicle. One firm has the following five vehicles in use :—Two 5-ton Edison lorries, two 1-ton Edison delivery vans, one ½-ton Edison delivery van. The above are charged by this department during the night, and represent a revenue of about £200 per annum, without involving the department in any additional capital expenditure for machinery or mains."

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Committee on Gas Traction.—Professor Cadman, director of the Petroleum Executive, announced on October 10 that Mr. Walter Long, M.P., the head of the Executive, had decided to form a committee on gas traction. It will consider the development of this form of traction, both now and after the war. The Petrol Controller is about to place greater restrictions on the uses for which petrol may be employed.

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Charges for Hire of Municipal Cars.—In view of the heavy addition to the working costs of the Glasgow Corporation garage owing to the war, the Garage Committee recommend that the present charge of 4d. per mile and 4s. 6d. per hour for the use of the cars by Corporation Committees and officials be increased to 6d. per mile and 6s. 6d. per hour.

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# MOTOR TRAFFIC.

## COMPRESSED COAL GAS FOR MOTOR LORRIES.

### A SUCCESSFUL GLASGOW EXPERIMENT.

Mr. Richard Liggett, of the Glasgow Gas Department, recently described before the Gas Department Foremen's Association his early experiments with coal gas as a fuel for motor lorries. A special committee of the Gas Committee was appointed about the same time to investigate the subject. With the assistance of this committee Mr. Liggett continued his experiments, and the results so far obtained are recorded in a report he has just presented, which is summarised in the *Gas World*.

For the purposes of Mr. Liggett's work nine cylinders were borrowed from the Cowlairs locomotive works of the North British Railway Company—one 6 ft. by 2 ft. 6 in., four of 8 ft. 9 in. by 1 ft. 6 in., two of 4 ft. 8 in. by 1 ft. 6 in., and two of 4 ft. 8 in. by 1 ft. 4 in., with ⅜-in. connection at one end, ends convexed. These were tested up to 250 lb. pressure. The two 4 ft. 8 in. by 1 ft. 6 in. were fitted, one on each side of the chassis, and one of the 4 ft. 8 in. by 1 ft. 4 in. at the rear of the chassis, thus getting a holding capacity of 400 cubic feet of gas at 200 lb. The other six cylinders were coupled together in the yard for the purpose of forming a quick charging battery. The battery contains 1,785 cubic feet of gas at 250 lb. pressure.

For compressing the gas Mr. Liggett made two force pumps, 4 in. diameter, 14 in. stroke, single-acting type, working alternately and driven by a crank fitted to a small punching machine, which is driven by a belt from the workshop shafting. During the time the motor is out on the district the pumps are compressing gas into the battery cylinders, to be ready for the next charge. The time taken by the pump to compress 400 cubic feet of gas is 80 minutes, the battery cylinders supplying the same quantity in four minutes, thereby saving a great amount of time.

For the trial runs a 25-H.P. Halley 2-ton lorry was selected, the unladen weight of which is 3 tons 11 cwts., including 5½ cwts., the weight of the three gas cylinders and fittings. The tests were carried out against a measured gallon of petrol as against 400 cubic feet of gas. The results are given in the table, as also the results of enriching the gas with petrol by two methods, neither showing good result :—(1) By blowing the gas at low pressure on to one gallon of petrol in the low-pressure tank (ordinary petrol tank), which is used to allow the gas to expand before being taken up by the engine. By this method 19 gills of petrol are absorbed. (2) By the gas blowing through the trap in which a measured gallon of petrol is placed. By this method six gills of petrol are absorbed. The trap mentioned is a 5-ft. length of 4-in. steam pipe, which is placed between the pumps and the gas cylinders of the car, to trap any oil or water which may come from the pumps.

#### Comparative Tests in Gas and Petrol.

With the assistance of Mr. Morrison, garage superintendent of the Caledonian Automobile Services, Limited, Mr. Liggett has obtained a comparison between gas contained in a flexible holder and gas contained in a steel holder, the test being on a run with a load of two tons. With the gas department motor, gross weight 5 tons 11 cwts., including steel holders containing 400 cubic feet of gas at a pressure of 200 lb. per square inch., the consumption of gas for seven miles was 235 cubic feet, time 40 minutes, consumption of gas per mile 33·57 cubic feet. The "Caledonian" motor, a 30-H.P. Halley, gross weight 5 tons, including flexible holder containing 330 cubic feet of gas, consumed all the gas in 6·3 miles; time, 36 minutes; consumption of gas per mile, 52·38 cubic feet. This shows 18·81 cubic feet per mile in favour of compressed gas.

#### Not Merely a War-time Expedient.

Mr. Liggett says that as a war-time or emergency expedient the flexible holder, in outlying districts, where the leakage of gas from the holder has plenty of space, may be very good; but in the city area, where many of the garages are low in the roof and very often close to or under dwelling-houses, the leakage from these holders would be somewhat objectionable and very dangerous. Their usefulness is also limited to the roofed vehicles; they are not suitable for lorry work.

Table of Results of Trials run between 400 cubic feet of gas, compressed to 200 lb. per square inch, and a measured gallon of petrol; outward and inward trials being run at various loads.

Gas costing 2s. 8d. per 1,000 cubic feet; petrol costing 2s. 2d. per gallon.

| July, 1917. | Gross Weight. Tons. | Cwts. | Distance (Miles). Gas. | Distance (Miles). Petrol. | Time (Minutes). Gas. | Time (Minutes). Petrol. | Per Mile. Feet. Gas. | Per Mile. Gills. Petrol. | Cost per Mile. Gas. | Cost per Mile. Petrol. |
|---|---|---|---|---|---|---|---|---|---|---|
| Gas— Out ... ... ... | 5 | 11 | 11·6 | — | 63 | — | 34·482 | — | 1·103d. | — |
| In ... ... ... | 5 | 11 | 13·6 | — | 65 | — | 29·411 | — | 0·941d. | — |
| Petrol—Out ... ... ... | 5 | 11 | — | 9·3 | — | 53 | — | 3·440 | — | 2·795d. |
| In ... ... ... | 5 | 11 | — | 12·0 | — | 70 | — | 2·666 | — | 2·166d. |
| Gas— Out ... ... ... | 5 | 0 | 11·1 | — | 65 | — | 36·036 | — | 1·153d. | — |
| In ... ... ... | 5 | 0 | 14·2 | — | 63 | — | 28·169 | — | 0·901d. | — |
| Petrol—Out ... ... ... | 5 | 0 | — | 10·0 | — | 47 | — | 3·200 | — | 2·600d. |
| In ... ... ... | 5 | 0 | — | 12·6 | — | 65 | — | 2·539 | — | 2·062d. |
| Gas —Out ... ... ... | 4 | 10 | 12·4 | — | 63 | — | 32·258 | — | 1·032d. | — |
| In ... ... ... | 4 | 10 | 15·6 | — | 74 | — | 25·641 | — | 0·820d. | — |
| Petrol—Out ... ... ... | 4 | 10 | — | 10·3 | — | 75 | — | 3·106 | — | 2·523d. |
| In ... ... ... | 4 | 10 | — | 12·7 | — | 63 | — | 2·519 | — | 2·046d. |
| Gas— Out ... ... ... | 4 | 0 | 13·3 | — | 58 | — | 30·075 | — | 0·962d. | — |
| In ... ... ... | 4 | 0 | 15·9 | — | 69 | — | 25·157 | — | 0·805d. | — |
| Petrol—Out ... ... ... | 4 | 0 | — | 11·7 | — | 50 | — | 2·735 | — | 2·222d. |
| In ... ... ... | 4 | 0 | — | 12·5 | — | 57 | — | 2·540 | — | 2·080d. |
| Gas— Out ... ... ... | 3 | 11 | 13·5 | — | 55 | — | 29·629 | — | 0·948d. | — |
| In ... ... ... | 3 | 11 | 16·0 | — | 67 | — | 25·000 | — | 0·800d. | — |
| Petrol—Out ... ... ... | 3 | 11 | — | 11·7 | — | 49 | — | 2·735 | — | 2·222d. |
| In ... ... ... | 3 | 11 | — | 13·1 | — | 59 | — | 2·442 | — | 1·984d. |
| Gas—Total ... ... ... ... | 22 | 12 | 137·2 | — | 642 | — | 29·154 | — | 0·932d. | — |
| Petrol—Total... ... ... ... | 22 | 12 | — | 115·9 | — | 583 | — | 2·781 | — | 2·243d. |

Note.—The unladen weight of vehicle is 3 tons 11 cwts. No hills were coasted, but all were driven down at a regular speed on brakes. No adjustments were made during trials.

Table of Results by Enriching Gas with Petrol. Out Runs only.

| | Weight. Tons. | Cwts. | Distance. Miles. | Time. Minutes. | Per Mile. Feet. Gas. | Per Mile. Gills. Petrol. | Cost per Mile. |
|---|---|---|---|---|---|---|---|
| (1) Blowing gas on to petrol in pressure tank ... ... ... ... ... | 5 | 11 | 14·6 | 70 | 27·390 | 19 | 1·933d. |
| (2) Compressing petrol with gas ... ... ... ... ... ... ... | 5 | 11 | 12·0 | 67 | 33·333 | 6 | 1·472d. |



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# MOTOR TRAFFIC.

The use of steel cylinders in this connection should not, according to Mr. Liggett, be considered as a war-time or emergency expedient, but as a further outlet for the use of coal gas and a serious competitor to electricity or petrol in the commercial life of the city. "Compressed gas in steel or rigid holders is," he remarks, "the practical solution to the problem of carrying a supply of gas for power purposes on motor vehicles."

Mr. Liggett proceeds:—"There are four principal objections to its use:—(1) Compression is the most serious item of expense, but can easily be overcome by the battery system referred to. The gas consumed in compressing 400 cubic feet of gas in the case under review is about 12 cubic feet, costing under a halfpenny. (2) On the motor vehicles which I have seen at several places the gas is drawn from the flexible holder and supplied to the engine by an ordinary gas connection fitted to the induction pipe at or near the governor valve, the air supply being drawn through the carburetter in the usual way. This method is certainly simple, as gas or petrol can be used as required, but it is a great waster of gas, and does not allow the best results to be obtained from either gas or petrol. To get the best results from gas, a special controller or carburetter for gas only should be used to supply the engine with a proper explosive mixture. The special controller which is used on the gas-driven motor of the department gives these results, combining simplicity with utility, and by the movement of a pin gas or petrol can be used without stopping the engine. The controller is made in eight parts, the four principal being inner sleeve, outer sleeve, air cuff, and gas cuff, and is fitted to the engine by a special connection or duct inserted between the flanges of the induction pipe and the petrol carburetter. (3) The governor or reducing valve may be an objection, but it is an indispensable fitting for compressed gas, and on it the driver depends to get a regular supply of gas at low pressure, the lowest pressure being necessary for the efficient working of the engine to drain the holders of the last foot of gas. The governor used is one I have specially designed for this particular work, and it has fulfilled the conditions required of it admirably. The principal parts are body piece, high-pressure tube, low-pressure tube, valve, diaphragm, balance, and socket. (4) Wear on tires due to the extra weight carried. This objection will not prove very serious when the great saving in fuel is taken into account."

RECOMMENDATIONS.

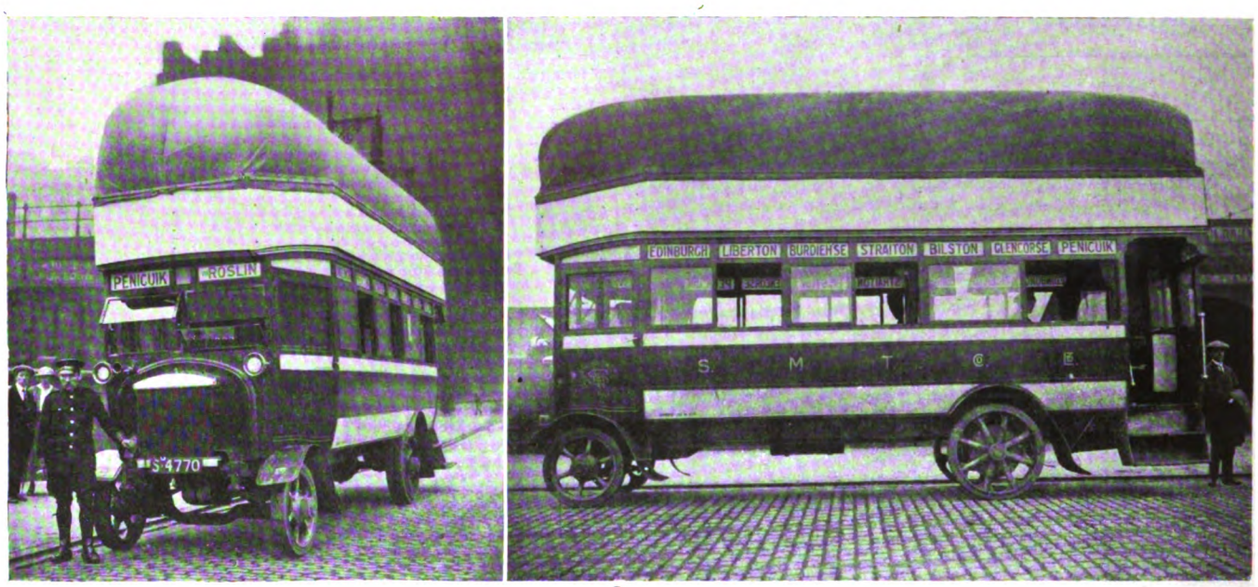
Mr. Liggett concludes his report with these suggestions:—(1) That the department prepare all their existing motors for gas. (2) That two experimental cylinders, 10 ft. by 4 ft., capable of withstanding 1,000 lb. pressure per square inch, be obtained, one to be mounted in place of the present battery to supply the department motors, and one to be mounted on a chassis to supply any consumer who may wish to give the system a trial. The system could afterwards be gradually extended. (3) That pumps or compressors be got to fill these cylinders with gas up to 1,000 lb. pressure per square inch in 60 minutes.

## ROADSIDE SUPPLIES FOR MOTORS.

The Commissioner of Police for the Metropolis has asked the local authorities for their views on any proposal that may be put forward for establishing on the footways of main roads appliances to enable mechanically-propelled vehicles to obtain supplies of water, petrol, electricity, etc.

Kensington Borough Council have been advised by the Highways Committee that it might be possible to grant sites, not necessarily in the main thoroughfares, where such fittings could be installed. Before permission was given the co-operation of the police should be invited to assist in determining the suitability of the site from a traffic point of view, and the granting of the site should be subject to an annual rental. Distinction should be drawn between the vehicles requiring water only, such as steam wagons, and such vehicles as may require petrol, electricity, or gas.

Bethnal Green Council "does not consider it practicable to place the proposed mechanical 'sources of supply' appliances upon the footways of main roads, but is of opinion that consideration should be given to any application for fixing such appliances in any side streets where pedestrian and vehicular traffic is negligible."




**Omnibus of Scottish Motor Traction Company Equipped with North British Rubber Company's Gas Holders.**

## GAS FOR EDINBURGH MOTOR OMNIBUSES.

The North British Rubber Company have come to the fore in meeting the demand for gas-holders, which is increasing daily. Their huge plant and long experience in the manufacture of rubber goods of every description gives the company an advantage in the making of flexible gas-containers, and the satisfaction expressed by the users serves to endorse the contention that there is no firm better able to provide exactly what is required. An increasingly large user is the Scottish Motor Traction Company, who run motor omnibuses in Edinburgh and district. Photographs are appended giving front and rear elevation views of a container fitted to one of the omnibuses. Another illustration shows a container fitted to a chars-a-banc of 35 H.P., supplied by Halley's Industrial Motors, Limited, of Glasgow. Ordinary domestic gas is utilised in this case without alteration of the carburetter, and the cost works out at approximately one-third of the price of petrol.

## HOLDER IN PLACE OF TOP DECK SEATS.

For the use of gas on the Todmorden Corporation omnibuses the top deck seats on one vehicle have been removed as an experiment. So far the trial has proved satisfactory, with the prospect of effecting a considerable saving in the running expenses of this and other vehicles.

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# MOTOR TRAFFIC.

## ANNUAL REPORT OF THE ROAD BOARD.

The report of the Road Board for the year ended March 31, 1917, gives the constitution of the Board as follows :—Sir George S. Gibb (chairman), Sir J. H. A. Macdonald, G.C.B., Lord Montagu of Beaulieu, Lord Pirrie, K.P., and Lord St. Davids, with Brigadier-General H. P. Maybury, C.B., manager and engineer (now serving as Director of Roads on the staff of the Director-General of Transportation in France), Mr. W. Rees Jeffreys, secretary, and Mr. J. S. Killick, acting engineer and manager. The last-named is the County Surveyor of Hertfordshire, and he was formerly assistant engineer to the Road Board. His services have been lent to the Board during Brigadier-General Maybury's absence with the British Expeditionary Force.

The applications received by the Board for advances during the year 1916-17 totalled £1,051,905, of which £966,510, or 91·88 per cent., was for "improvement of road crusts." The advances applied for show an increase of £741,644 as compared with 1915-16, and a decrease of £949,359 as compared with 1914-15.

RECEIPTS AND PAYMENTS.

The receipts credited to the Road Improvement Fund and the payments out of the fund up to March 31, 1917, are summarised in the following statement :—

| Receipts and Payments. | Year ended March 31, 1917. | Total. |
|---|---|---|
| RECEIPTS. | £ | £ |
| Motor spirit duties ... ... ... ... | — | 4,075,608 |
| Carriage licences ... ... ... ... | — | 2,786,809 |
| Interest and profit on investments and loans | 152,902 | 530,680 |
| | 152,902 | 7,393,097 |
| PAYMENTS. | | |
| Administrative expenses ... ... ... | *17,167 | 93,086 |
| Paid under grants ... ... ... ... | 318,636 | 2,976,782 |
| Paid under loans ... ... ... ... | 110,124 | 1,090,227 |
| | 445,927 | 4,160,095 |
| Deduct loans repaid ... ... ... | 191,359 | 496,598 |
| Net payments ... ... ... ... | 254,568 | 3,663,497 |

* Including £4,912 expenditure in connection with acquisition and equipment of offices in South Kensington. This capital outlay will enable an annual saving of about £600 to be made in rent, etc.

PURPOSES OF GRANTS AND LOANS.

Grants and loans made up to March 31, 1917, have been made in respect of the following classes of improvement work in the United Kingdom :—

| Classification. | From May, 1910, to March, 1916. | | During Year ended March, 1917. | |
|---|---|---|---|---|
| | Grants. | Loans. | Grants. | Loans. |
| | £ | £ | £ | £ |
| Improvement of road crusts ... ... | 3,253,444 | 947,712 | 186,274 | 103,820 |
| Road widenings and improvement of curves, gradients, and corners ... ... | 293,744 | 26,843 | 1,412 | 6,304 |
| Road diversions ... | 69,895 | 4,060 | 624 | — |
| Reconstruction and improvement of bridges | 86,525 | 280 | 863 | — |
| New roads and bridges | 538,849 | 1,208 | 2,035 | — |
| Total ... ... | 4,242,457 | 980,103 | 191,208 | 110,124 |

Great advantage has been derived since the outbreak of the war from the improvements effected on important roads with the assistance of grants and loans from the Road Improvement Fund. But the heavy motor traffic due to the war had caused great damage, and notwithstanding the expenditure of nearly one and a half millions for special work out of army and other Government contributions, an extensive road mileage had greatly deteriorated. The expenditure by highway authorities on maintenance had been reduced for financial reasons, and also owing to the shortage of labour, and considerable leeway would therefore have to be made up after the war before the roads were restored to their pre-war condition.

POLICY DURING THE WAR.—WORK DONE FOR GOVERNMENT.

Meanwhile the policy of the Board in regard to making grants and loans has been continued on the lines laid down by the Treasury, as set forth in paragraph 12 of the Board's report for 1915-16. During the current year the Board are distributing, with Treasury sanction, a sum of £200,000 out of the Road Improvement Fund mainly in the form of assistance to expenditure on tar treatment of main county roads in Great Britain which are in a suitable condition for tar treatment. In doing so they are endeavouring to secure that sections of road which were improved with the aid of Road Board grants prior to the war shall be preserved, as far as possible, in a condition which will prevent the benefit of improvements already made being lost.

Apart from the question of deferred maintenance expenditure and special damage caused to roads by heavy motor traffic in connection with the war, the question of expenditure required in the near future for the improvement of roads has been considered, and the Board's views thereon are set forth in a letter dated January 19, 1917, addressed to the Reconstruction Committee.

The Board have continued the special work which they undertook after the outbreak of war at the request of the Army Council. Similar work has, with Treasury approval, been undertaken for the Admiralty, Ministry of Munitions, and Timber Supply Department of the Board of Trade. The total estimated expenditure on works sanctioned by the aforementioned departments up to March 31 last, which have been or are being carried out by or under the supervision of the Board, is £2,760,141, of which the sum of £2,364,541 is on account of the War Department.

## DUNLOP'S NEW DEPARTURE.

A Commercial Vehicle Owners' Department has been established by the Dunlop Rubber Company, whose knowledge and experience are at the service of firms on their register of owners under their "pink form" agreement.

Any owner of a commercial delivery van used exclusively for the conveyance of goods is entitled to enter his name on the company's "pink list," and by so doing he will, we are officially informed, save a substantial amount on all purchases of Dunlop tires and accessories, besides receiving free advice on all matters appertaining to them.

The Dunlop Company's new trading season having commenced on October 1, owners of delivery vans not already on the list should write to the "C.V. Department," Dunlop Rubber Company, Limited, Aston Cross, Birmingham, for particulars of the advantages conferred by it.

STANDARDISATION OF AMERICAN MOTOR TRUCKS.—Fifty automobile engineers were called to Washington in August to serve on the Board for the standardisation of motor trucks and parts. The War Department have taken over the work from the Society of Automotive Engineers. Arrangements were made for the accommodation of 100 or more draughtsmen, tracers, etc., and many manufacturers offered their assistance. The Continental Motor Company placed at the Government's disposal the whole of their drafting-room staff and equipment, an offer which was promptly accepted.

YORK OMNIBUSES AND VOLUNTEER SERVICE.—A suggestion has been made that the electric omnibuses of York Tramways Department might be registered with the local squadron of the Motor Volunteer Corps, and that the department should provide uniforms for such of the drivers who might join the corps. The Tramways Committee have replied that they do not consider the vehicles useful for the purpose, having regard to the circumstance that they required stations for charging. As to uniforms for the men, the committee do not consider that the Corporation should bear the cost.

PASSING SLOWLY-MOVING AND STANDING VEHICLES.—The attention of the London "Safety First" Council has been called by St. Pancras Council to the great danger to pedestrians owing to fast-moving traffic being permitted to pass both on the near and off sides of slowly-moving or standing vehicles, and to suggest that a regulation is very desirable in this connection. The "Safety First" Council have replied that the suggestion has been considered, and that opportunity will be taken of inviting the attention of the Commissioners of the Metropolitan and City Police to the point.

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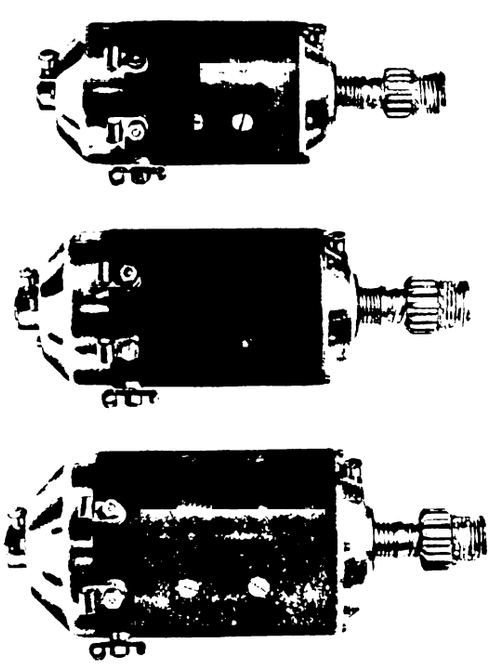
# MOTOR TRAFFIC.

## THE C.A.V. GEARED ELECTRIC STARTERS.

An electric starting motor may either be a separate machine or may be combined with a lighting dynamo, these taking the form of a single dynamotor. It is not yet possible to say with absolute certainty which type will ultimately prevail, but there are many and strong arguments in favour of the separate motor, the designer of which has to concentrate only on a single problem and so is enabled to secure the maximum degree of simplicity and efficiency. To combine the functions of a lighting dynamo with those of a motor involves certain complications in respect always of field magnet windings and sometimes also of armature windings. The problem of transmission between the electric machine and the car engine also becomes an extremely difficult one. Even if, by the adoption of separate machines for the two jobs, this transmission problem is simplified as far as possible, it is still by no means easy of solution. Looked at from this side of the case, separate starting motors may be divided into two groups, namely, those which drive by friction and those which drive through positive gearing. A satisfactory positive drive is difficult to arrange for certain reasons. First, the operation of the starting motor must be brought about in as simple



The C.A.V. Geared Electric Starters.

a manner as possible. The movement of the switch which allows current to flow through the windings must also suffice to complete the transmission. The gears must be brought into mesh without shock, and until they are fully in mesh the motor ought not to attempt to exert its full power. Otherwise, damage to the edges of the gear teeth may ensue. Later on, when the engine has started and is running under its own power, the transmission must be automatically disconnected, as there is a risk that the armature of the starting motor will be pulled round at an excessive speed and damage will result. If the designer can meet all these conditions while providing a positive drive, he will no doubt prefer to do so rather than to use a friction drive. The positive method in its best forms can be cheaper, lighter, more efficient and more simple to instal in a satisfactory manner.

Mr. A. H. Midgley, the designer of the C.A.V. geared starters has satisfied himself and others that the difficulties connected with the positive drive can all be overcome, and also that a better electric installation is provided by using a separate dynamo and motor than by using a combined dynamotor. The accompanying photograph shows the three sizes of the C.A.V. geared electric starters. The smallest is for engines up to 16 H.P., the second for engines up to 40 H.P., while the largest is powerful enough to start engines up to 150 H.P. All three are identical as regards the principles of their design. The method by which the transmission gears are engaged and disengaged is highly ingenious and satisfactory. The transmission consists of a pinion upon the armature shaft of the motor, which must be brought into mesh with gears cut on the periphery of the engine flywheel. The gear ratio of the transmission varies from 8 to 1 to 12 to 1, and the starting motor, running at 1,200 to 1,500 revolutions per minute turns the engine crankshaft at 100 to 150 revolutions per minute, according to circumstances.

The armature of the starting motor is normally pressed endways by a controlling spring, so that it does not lie exactly in the centre of the magnetic field which is created as soon as current flows through the field and armature windings. Directly this happens, the pull of the magnetic field draws the armature endways over a distance of about a quarter of an inch against the pressure of the controlling spring. This brings the pinion on the armature shaft just into mesh with the gears upon the engine flywheel, the current flowing through the coils of the motor being for the time only a light one. The first meshing of the gears is thus brought about without shock. The complete meshing is due to a totally different cause.

The pinion on the armature shaft is not keyed to the shaft, but is arranged to run upon a quick screw thread. When the motor is at rest, the position of the pinion is determined by the light coiled spring shown in the photograph. As soon as the pinion begins to mesh with the gears upon the flywheel, the rotation of the armature causes it to spin along the screw thread, stretching the spring and completing the full engagement of the gears. While this is happening, the electrical connections are so varied that the motor commences to develop its full power, and directly the gears are thoroughly engaged it exerts all the force that is necessary to turn the engine crankshaft at the required speed to ensure prompt starting. When the engine begins to run under its own power, the gears upon the flywheel over-run the pinion on the armature shaft and consequently screw the pinion away out of engagement. This movement is assisted by the light coiled spring. At the same time, the starting motor, being relieved of its work, ceases to take current from the battery, and the magnetic field falls away and allows the armature to be pushed bodily by its controlling spring back to the normal stationary position. This movement, of course, helps to bring about the certain disengagement of the transmission.

We have referred to the fact that the strength of the current is increased while the transmission gears are being brought into mesh, and a brief explanation as to how this is effected becomes necessary. The operation of the starting motor is brought about by the pressure of the foot upon the pedal switch. The first movement of this pedal allows current to flow through two of the four field coils of the motor. These two coils are wound with wire of somewhat high resistance. The circuit is completed through a portion of the armature coils, of which the remaining portion is for the moment cut out of action by a subsidiary brush which, in addition to the two main brushes, bears upon the commutator. As the pedal is depressed still further, this subsidiary brush is thrown out of action, so that the current passes through the whole of the armature windings. At the same time, the other two field coils which are wound with stout wire of low resistance are brought into circuit in parallel with the first two already mentioned. The motor is now able to take its full current and to develop full power to overcome the first inertia of the car engine.

The system of engagement is original when regarded as a combination of actions, each one of which singly is already known and used. The system of varying the current is, so far as we are aware, now employed for the first time in this form.

As befitting the C.A.V. products, the motors are admirably constructed and beautifully finished, all the materials employed having been very carefully selected. The machines are light, and their simplicity makes it possible to produce them at a thoroughly competitive price. They are in every way calculated to uphold the high reputation of the electric equipments which come from Messrs. Vandervell's works.

MOTOR DELIVERIES FROM A COMMUNAL KITCHEN.—During the first week in September the Hammersmith Council opened a public kitchen at the local baths, to which five distributing centres are attached. The enterprise is connected with the effort to conserve the food supply, and in course of time it is intended to increase the number of depots to fifteen, thus providing for 30,000 meals a day. The food is delivered by motor vans from the central kitchen Two Ford vehicles suffice to serve the first five depots. The charges for the food have been arranged so that no burden can fall on the rates, and it is hoped that a profit will be made so as to enable the Council to gradually pay off the sum of £1,650 expended on fitting up the kitchen and purchasing the vans.

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# MOTOR TRAFFIC.

## TESTS OF NAPIER LORRIES.

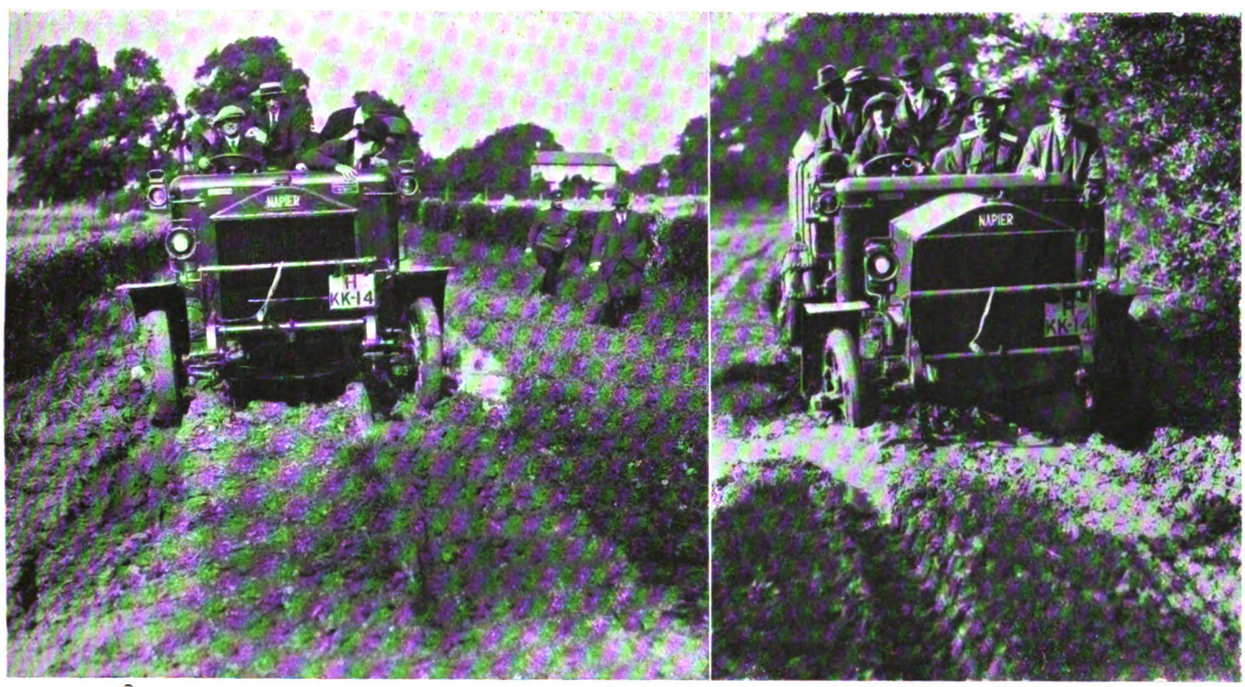
For the Russian Forces.

It is not generally known that transport lorries for the British and Allied Governments are subjected in this country to most arduous tests under real battle front conditions, i.e., over ground

A Russian General Inspecting the Chassis.

embracing seas of mud, road obstacles, and steepest gradients, with full load up. The accompanying photographs give a vivid idea of what the test means and what the lorries go through in the various war areas as they carry ammunition to batteries which are seldom adjacent to a road. The vehicles shown undergoing the tests are Napier lorries built for our Russian ally, and one photograph shows the inspection by the Russian General and his staff, all of whom are expert engineers. The other two views speak for themselves; the lorry is going through a veritable sea of mud.

It is satisfactory to know that the Napier came through the test with flying colours without an involuntary stop. The total weight is just under 8 tons, including chassis, body, ballast, and passengers, which makes the performance all the more remarkable, and a further tribute to British workmanship.




Napier Lorries Undergoing Tests.

## MOTOR TRANSPORT FACILITIES.

Great Growth of Roadside Depots.

The Commercial Motor Users' Association, 83, Pall Mall, S.W.1, have published a handbook of "Approved Depots," at which owners and drivers of motor wagons are assured of the necessary roadside facilities to enable their important work to proceed. At no time in the past fifteen years has more reliance been placed upon motor transport than is now inevitable. Munitions, food supplies in all categories, and much passenger transport of national importance have become increasingly dependent upon quick conveyance by road; the Association's efforts are directed towards the provision of efficient housing, maintenance, and supply service along all the principal trunk routes, both for man and vehicle.

The following routes are exhaustively organised, according to the data in the Handbook, London being treated as the starting (or terminal) point in each case:—(1) Grantham, Doncaster, and Newcastle-upon-Tyne; (2) Cambridge and King's Lynn; (3) Norwich and Great Yarmouth; (4) Colchester, Ipswich, and Lowestoft; (5) Canterbury, Margate, and Sandwich; (6) Folkestone and Dover; (7) Tonbridge and Hastings; (8) Brighton; (9) Portsmouth; (10) Winchester, Southampton, and Bournemouth; (11) Salisbury, Exeter, and Plymouth; (12) Bristol and Plymouth; (13) Bath, Bristol, and Weston-super-Mare; (14) Gloucester, Cardiff, and Swansea; (15) Oxford and Worcester; (16) Birmingham, Liverpool, and Manchester. Sundry extensions are also indicated.

The alphabetical lists of information cover the principal towns and villages on all routes. The approved depot is indicated on a street map, whilst the text sets forth the accommodation in detail, as regards different classes of commercial motor—petrol, steam, or electric. A separate section goes into detail concerning existing charging facilities for electric vehicles. There are also sections dealing with legal matters, tire-pressing stations, coal and coke depots, lights on motor vehicles, technical hints for drivers, a directory of British commercial motor forms, and an index. Mr. F. G. Bristow, the secretary, compiled the Handbook, which comprises 300 pages, and is sent post-free for 1s. 9d.

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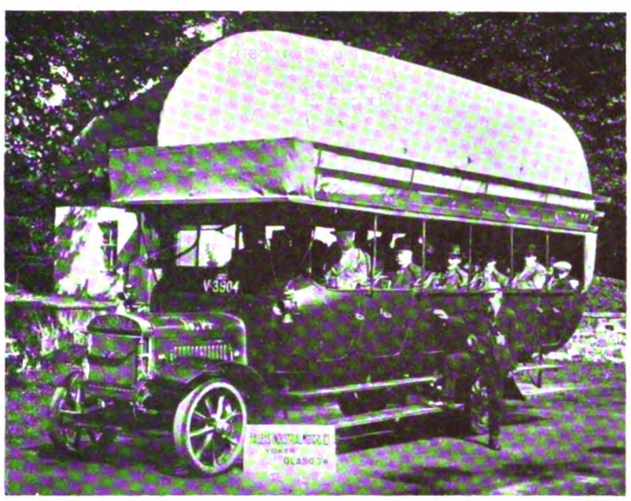
# MOTOR TRAFFIC.

## HALLEY GAS-DRIVEN CHARS-A-BANC.

The appended illustration shows a 35-H.P. Halley chars-a-banc running on ordinary domestic gas without any alteration of the carburetter. The cost of running on gas in the case of this vehicle is, we are informed, approximately one-third that of petrol.



## ALBION TANK WAGONS.

By special permission of the War Department, the Albion Motor Car Company, Limited, has recently supplied to the Union Petroleum Products Company, Limited, the tank wagon shown in the accompanying illustration The wagon has a capacity of 1,000 gallons, and is driven by an engine of 32 H.P. This is the fourth repeat order

placed with the Albion Motor Car Company by the same firm, and it indicates in a way which must be highly gratifying to the makers the sound design and excellent running qualities of their chassis.

RED CROSS CARS SUPPLIED BY MINERS.—The Yorkshire Miners' Association have subscribed £45,306 for providing ambulances for the British Red Cross Society, paying levies of from 1s. to 3s. a week.

CO-ORDINATION OF ENGINEERING TRAINING.—A movement is on foot to establish a central organisation for the improvement and better co-ordination of engineering training, and the appointment of a representative committee of engineering and educational interests to initiate action. The proposal is arousing much interest in engineering and educational circles, and Sir Maurice Fitzmaurice, president of the Institute of Civil Engineers, will preside at a meeting to consider the scheme at the Institute on October 25.

## HALLEY WAGON FOR WAR SERVICE.

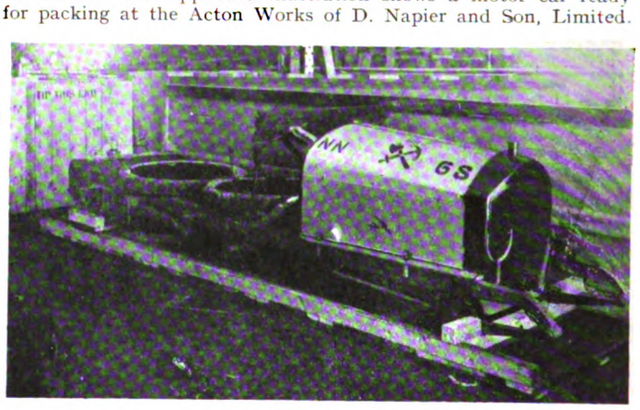
An increasingly large number of motor vehicles is being supplied to the War Department for use with the British armies abroad by Halley's Industrial Motor Company, of Glasgow. These vehicles are also a familiar feature for military and munition work on the

**45-h.p. 4-ton Halley Tipping Wagon.**

roads of the United Kingdom. The subjoined photograph depicts one of the latest tipping wagons of 45 H.P. supplied to the War Department.

## NAPIER CAR PACKED FOR TRANSPORT.

Besides supplying many thousands of cars, lorries, and aircraft for the British naval and military forces, the motor manufacturers of this country have contributed very largely to the resources of our Allies. The appended illustration shows a motor car ready for packing at the Acton Works of D. Napier and Son, Limited.



**Napier Car Being Packed for Export.**

Long experience, before and during the war, has rendered the despatch staff of Napier and Son adepts at this ingenious method of preparing cars for shipment. The result is that the minimum of space is occupied in transit, and the machines are easily re-assembled at the port of debarkation.

MEN FOR THE MECHANICAL TRANSPORT CORPS.—An announcement has been issued stating that men are urgently required for enlistment in the mechanical transport section of the A.S.C. Skilled motor drivers are accepted between the ages of 35 and 50 years, and men over military age as motor mechanics. Men of low medical categories, of 25 years and over, can enlist as learners. The pay is 2s. 2d. a day and separation allowances.

CONTAINER EQUIPMENT PROGRESS.—A. Barton and Sons, of Beeston, Notts., have now disposed of nearly 400 flexible gas containers for public passenger and commercial vehicles, and a considerable number of orders are in hand.

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# MOTOR TRAFFIC.

## GLASGOW'S CLEANSING MOTORS.

Mr. W. Greig, superintendent of the Cleansing Department of Glasgow Corporation, in his annual report, states that the department has two petrol refuse removal vans, two electric removal vans, twelve petrol street sweepers, and one traction engine and trailers for farm work. The two petrol 3-ton wagons have been utilised since the begininng of 1913 for the removal of domestic refuse. Whilst these wagons are advantageous in some respects, notably in the rapid transit of the material to the destructor works, the cost, due mainly to the numerous stoppages during the process of collection, does not compare favourably with horse haulage. The respective figures are :—Petrol motor traction, 3s. 9·52d. per ton ; horse traction, 3s. 3·15d. per ton. Extensive repairs have again been required by these machines, and on several occasions they have been out of commission owing to the difficulty of obtaining materials for carrying out the necessary repairs. This explains to some extent the high cost above stated. Further, experienced drivers and mechanics are difficult to obtain, and it is obvious that these machines are labouring under a severe handicap under present conditions. In the circumstances any statement of costs is not of real value, and does not admit of a fair comparison. Pending a return to normal times better results can scarcely be expected.

Two Edison 2-ton electric vehicles have been purchased. The wagons were put into commission on December 13, 1916, and May 1, 1917, respectively, and so far the results obtained seem to be fulfilling expectations. The figures for the partial period are :—Electric vehicles, 2s. 10·65d. per ton ; horse traction, 3s. 3·15d. per ton.

The fleet of petrol-driven street sweepers numbers twelve. While the results obtained compare favourably with horse haulage, it is evident that even more advantageous results may be looked for in normal times. The remarks made in connection with the petrol wagons in regard to difficulties attending upkeep, etc., are applicable in this case also. As compared with horse haulage, the working costs are :—Petrol street-sweeping machine, 3·81d. per 1,000 square yards swept ; horse-drawn street sweepers, 4·78d. per 1,000 square yards swept.

Traffic Inducement by the L.G.O.C. Group.—Throughout the war the London General Omnibus Company have maintained their spirited and admirably conceived work at traffic inducement on behalf of the allied underground and road transport organisations. "The American's London" is the subject of the latest series of announcements now appearing in various London newspapers, and it is proving of interest to the general public as well as to the sailors and soldiers of the United States, and to those of Canada, who are to be seen in the Metropolis. The announcements give valuable information relating to the ancient buildings that have an association with historic personages who were identified with this country and America.

## AUSTIN FLEET OF OMNIBUSES.

An indication of the wide district from whence the Austin Motor Company draw their large number of employees is given in the appended photograph of a portion of the company's fleet of motor omnibuses Ten of these single-deck vehicles are depicted standing outside the Northfield Works, Birmingham. As each conveyance can accommodate not far short of twenty-five passengers, it will be understood that the Austin Company have a large number of workpeople residing beyond the limits of other means of locomotion. In addition the company's enterprise no doubt enables other employees to arrive at the works earlier than if they relied upon public conveyances.

The importance of bringing employees to their daily tasks in as fresh a physical condition as possible has long been recognised. At no period, however, has it been more necessary than during the three years of strenuous work necessitated by the waging of the world-wide battle against the enemies of civilisation. The Austin Motor Company's experience in the transport of their workpeople should prove the more valuable because of the large number of vehicles employed, and when they are at liberty to again manufacture for the wants of the public generally they will have some interesting statistics of working costs with which to assist their sales, if such an excellent machine as the Austin needs that aid.

Austin Fleet of Motor Omnibuses.

## SPECIAL RAILWAY WAGONS FOR AUTOMOBILES.

Railway traffic in America in automobiles has grown to such great proportions that the railways find it worth while to furnish the manufacturers with the greatest facilities for the transport of motor cars. A number of the railways provide closed wagons for the purpose. One of the latest types of these wagons has been constructed for the Chicago and North Western Railway by the Western Steel Car and Foundry Company. The wagon has a large centre door providing easy access for the vehicles, which are carried in complete security.

Institution of Automobile Engineers.—At the opening meeting on October 10 of the 1917-18 session of the Institution of Automobile Engineers, held at the Royal Society of Arts, the presidential address was given by Lieut.-Colonel R .K. Bagnall-Wild, chief inspector of the Aeronautical Inspection Department. Mr. L. A. Legros, the retiring president, mentioned that Colonel Bagnall-Wild had during the past four years organised a body of 5,000 inspectors, recruited from every class and rank of trade. Aircraft construction turned to useful account men whose trade was entirely different before the war. The organ-builder was the best man for the erection of aeroplanes. Next to him came the pattern-maker, and the chair-maker in civil life easily surpassed all others in the making of propellers.

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# MOTOR TRAFFIC.

## MOTOR TRAFFIC NOTES.

NEW COMPANY TO MANUFACTURE ELECTRIC VEHICLES.—The Grimsby Electric Vehicle Company, Limited, has been registered with a capital of £5,000 for the manufacture of battery-propelled vehicles.

MOTOR CYCLE AMBULANCE.—Mr. F. W. Sykes has presented a motor-cycle ambulance for the conveyance of wounded soldiers at Huddersfield. It will accommodate any single stretcher, and is electrically lighted.

OMNIBUSES AND ROAD PAYMENTS.—Berkshire County Council have forwarded a resolution to the County Councils of the United Kingdom requesting that legislation be introduced for the payment of a fair mileage rate by the proprietors of motor omnibuses. It is being generally adopted.

U.S.A. MOTOR FUEL FROM BARLEY.—Under the Food Conservation Law of the United States, which came into operation on September 8, the use of barley for the distillation of spirits was prohibited. Sixty million bushels are being released, however, for the manufacture of denatured alcohol for motor fuel and other purposes.

COMMERCIAL VEHICLES FOR NATIONAL EMERGENCIES.—The London Chamber of Commerce is organising a meeting of owners of commercial motor vehicles which is to be addressed by Field Marshal Lord French, who will explain his desire for the enrolment of such vehicles in the Motor Volunteer Corps for national emergencies.

USE OF THE RED CROSS ON CARS.—It is officially notified that permits to use the Red Cross emblem on motor cars must in all cases be applied for, and will only be granted if the car fulfils these two conditions:—(1) That it is used solely for the conveyance of sick and wounded soldiers; (2) that it has been placed at the disposal of the military authorities for this purpose.

AMERICAN WOMEN AS VOLUNTEER MOTOR DRIVERS.—More than 3,000 calls for drivers of passenger cars and motor trucks had been answered by the emergency drivers of the women's section of the Navy League at Chicago up to August 10. Society women have abandoned the limousine wheel for that of the truck, carrying tents, food or clothing to the naval training station at Great Lakes, Ill. The League will supply a woman driver for an army or navy truck within a few minutes after such a driver is requested.

RAID CASUALTIES IN COMPARISON WITH STREET ACCIDENTS.—During the first nine months of this year (January 1 to September 30) 487 persons were killed, and 14,104 injured in traffic accidents in the metropolitan police district—a number well below the normal, due to reduction in volume of traffic—while during the same period 191 persons were killed and 749 wounded as the result of aeroplane raids. Of the 749 wounded a great number only received slight injuries. From this it is apparent that the losses caused by aeroplane raids are not so serious as might be inferred.

THE PROFITABLE LOAD FOR OMNIBUSES.—Following an accident to a motor omnibus in the Gower peninsula, there has been a newspaper discussion on the alleged dangers of heavy passenger motor traffic. The *South Wales Daily Post* remarks that the omnibus proprietors make out a good case when they point to "their wonderful immunity from serious accident on the hilly roads of Gower. There is no doubt the omnibuses are good, and that the institution of double-deck vehicles would probably lead to more roof travelling, and therefore more danger. They, however, rather overstate the case when they say in effect that they are commercially called upon to take big loads, because they find that less than 34 seated passengers per omnibus does not pay."

## MOTOR VEHICLES FOR MUNICIPALITIES.

CARDIFF COUNCIL have decided to construct a garage for electric vehicles.

WALTHAMSTOW COUNCIL have ordered a 5-ton steam wagon for the use of the highways department.

BOLTON COUNCIL have referred to a sub-committee the tenders received for the supply of a 2-ton battery vehicle.

BODMIN STREETS COMMITTEE have been directed to consider the question of obtaining a mechanical street sweeper.

LAMBETH COUNCIL have accepted the tender of the Lacre Motor Car Company for the supply of a road sweeping machine.

LONDON COUNTY COUNCIL have purchased a second-hand car for the use of the officer in charge of the ambulance service.

MANCHESTER COUNCIL have placed a contract with Newton and Bennett, Limited, for the supply of a motor car for the gas department.

HOLLAND COUNTY COUNCIL have referred to committee an application made by the medical officer for a motor cycle to be purchased for use in the Council's service.

WEST HAM COUNCIL have applied to the Local Government Board and to the Ministry of Munitions for permission to order six battery vehicles for dust collection.

SALFORD COUNCIL have been recommended by the Lighting and Cleansing Committee to obtain a 2-ton battery tipping wagon from Edison Accumulators, Limited, at £1,123.

BRADFORD GUARDIANS have been recommended to obtain a two-seated car for the use of the workhouse master in place of another car which is being used for the visitation of the Board's various institutions.

KENSINGTON COUNCIL have applied to the Petrol Control Committee for a licence to enable petrol to be obtained for a car which it is proposed to purchase for the use of the superintendent of outdoor work.

WALSALL COUNCIL have purchased a second-hand steam lorry for the gas department, in place of a new vehicle for the supply of which they were unable to obtain a priority certificate from the Ministry of Munitions.

CAMBERWELL COUNCIL have made an allowance of £20 per annum to one of their sanitary inspectors for the upkeep and repair of a motor cycle, which he is obliged to use in consequence of having lost a leg during his service with the army.

NORFOLK COUNTY COUNCIL have agreed to the county surveyor inspecting two second-hand tractors offered for sale at £500 each, with a view to purchasing one for the cartage of granite and gravel for the roads in the western part of the county.

SOUTHEND COUNCIL have received the sanction of the Ministry of Munitions to the manufacture of four battery vehicles ordered from Messrs. Ransomes, Sims and Jefferies. As there is no definite guarantee as to the date for delivery, the surveyor has been instructed to obtain a higher priority certificate if possible.

NEWCASTLE STREETS COMMITTEE have sanctioned a proposal by the engineer's department to purchase an electric wagon at an estimated cost of £1,123. Mechanical traction is rendered necessary by the shortage of horses and the increased charges for hired cartage. The increase amounts to 78 per cent. on the pre-war rates. A statement presented on the cost of working the present battery wagon during 41 weeks shows that there had been a saving of £195, or 32 per cent., as compared with the cost that would have been entailed by the use of horses.

## PETROL ECONOMY OFFICER.

Mr. Walter Long, M.P., who has been requested by the War Cabinet to take control of all questions affecting petroleum oils and petroleum products, has appointed Professor Cadman, C.M.G., Petroleum Adviser to the Colonial Office and Professor of Mining of the University of Birmingham, to be his technical adviser and liaison officer between the various Government departments. Professor Cadman will also take charge of an organisation which will be established for giving effect to Mr. Long's instructions, and will assume the title of Director of the Petroleum Executive. Mr. E. S. Shrapnell-Smith, chairman of the Joint Committee of Mechanical Road Transport Associations, has been appointed Economy Officer to the Petroleum Executive, and he will be concerned in introducing economies both in His Majesty's Services and in the civil use of petroleum and petroleum products. The headquarters of the Petroleum Executive are at 8, Northumberland Avenue, London, W.C.2.

## MOTOR COMPANIES' REPORTS.

VAUXHALL MOTORS COMPANY are paying an interim dividend of 9d. per share.

NORTHERN GENERAL TRANSPORT COMPANY.—An interim dividend at the rate of 5 per cent. per annum (6d. per share) has been declared on the ordinary shares for the past half-year.

BIRMINGHAM SMALL ARMS COMPANY.—This company, which includes the Daimler Motor Company, have declared a final dividend of 5 per cent., and a bonus of 10 per cent., on ordinary shares, making 20 per cent., free of income-tax, for the year ended July 31. The ordinary shares received for 1915-16 the same amount as is proposed for the past twelve months. In 1915 the ordinary share capital was increased by one-half by the capitalisation of a portion of the reserve fund. The present distribution is therefore equal to 20 per cent. on the previous capital. The ordinary shares received 30 per cent. for 1914-15, and 15 per cent. per annum for many preceding years.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, NOVEMBER 15, 1917. VOL. XLII.

# TRAMWAYS ON BRIDGES OF REINFORCED CONCRETE.

TWO EXAMPLES IN LONDON.

Municipal bodies, until comparatively recent times, have been chary of using reinforced concrete in many of their structures. The success of this concrete depends essentially upon constant, careful, expert, and reliable supervision throughout the preparation and erection of the material. This was not always available. Moreover, in the case of structures serving street tramways the fitting of the forms *in situ* caused such a lengthy obstruction to traffic that ready-made parts of steel were preferred. The three following examples are interesting, the first from its novelty, the second as the first structure of its kind carrying a tramway in London, and the third because of the small amount of obstruction to traffic during the work, owing to the "precasting" of the ferro-concrete members of the bridge.

The first highway bridge in London constructed of reinforced concrete is the single 32-ft. span, Whiston Street Bridge, Shoreditch, over the Regent's Canal. There is, however, no tramway over this structure. It was built by the Shoreditch Borough Council's engineer, Captain T. H. Hustler, against considerable opposition. The bridge works were let to Messrs. Higgs and Hill, Limited, South Lambeth, and the plans and specifications, on the Hennebique system, were prepared by Messrs. L. C. Mouchel and Partners. The construction was begun in 1910, and the bridge was tested and passed on April 13, 1911. It superseded an old one of brickwork and cast-iron, and many large gas-mains and electrical cables had to be kept intact during the reconstruction.

Two years later, on May 5, 1913, the construction

Fig. 1.—London County Council Double-Deck Car Crossing New North Road Ferro-concrete Bridge.

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of a more important bridge was started by the same firms. This carries the New North Road, Shoreditch, over the Regent's Canal Dock, and took the place of an old semi-elliptical, two-ring, brick arch bridge 25 ft. wide, with a span of 25 ft. 6 in. The new bridge, which is shown in Figs. 1 and 2, is a single 43 ft. 6 in. span 53 ft. wide, and carries a double line of the London County Council Tramways. To provide space for these tracks the span was increased by 18 ft. and the width by 20 ft.

The New North Road is an important link in the alternative route from the East of London to the

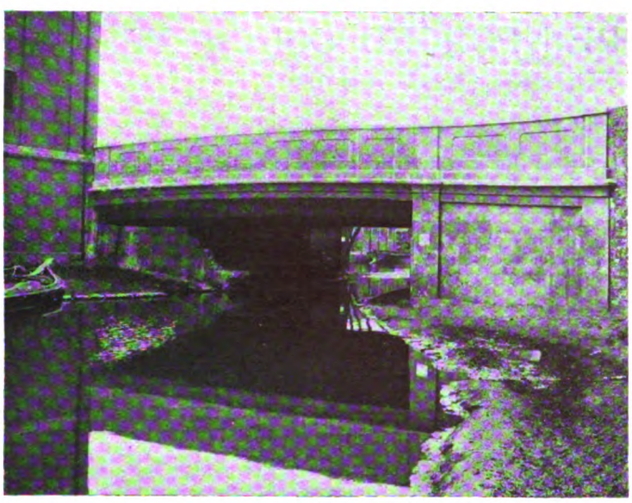

Fig. 2.—New North Road Ferro-concrete Bridge.

Great North Road at Highbury, and the traffic on it is very heavy. Under the footways there are many mains and room for more. Those now laid consist of 24-in. and 18-in. water-mains, a 4-in. gas-main, a 3-in. post office telegraph main, and a 6-way electric cable

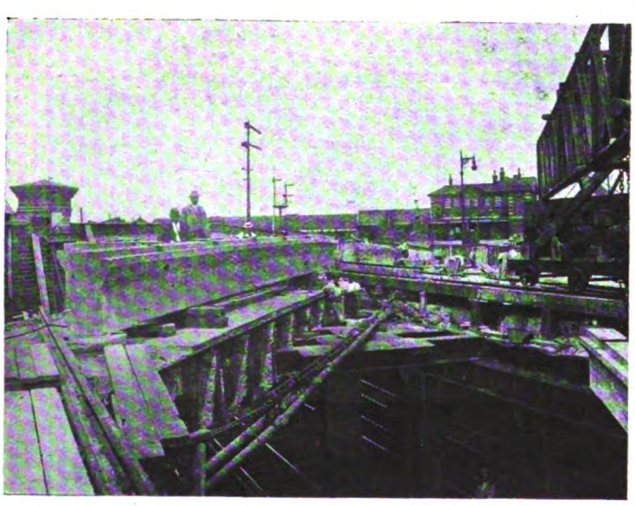

Fig. 3.—St. John's Hill Bridge—Beams Ready to be Lowered.

conduit. The maximum load to be carried is 32 tons on a 6 ft. 6 in. by 8 ft. wheel-base. The bridge, which is on the skew, consists of 11 longitudinal and four transverse beams; these are stopped at either side of the tramway conduit in order to form a continuous trough. The parapets are 8 ft. deep, and form girders which add greatly to the strength of the structure. The abutment and wing walls are of ferro-concrete, 14 ft. 6 in. to 17 ft. high, made of vertical slabs 7 in. thick, stiffened by columns and counterforts. The construction is monolithic, and is so reinforced as to transfer to the steel all tensile stresses. The total load of the engine and wagon was 40 tons, or 10 tons more than the specified test; under this the maximum deflection was one-twelfth of an inch, or one-tenth of

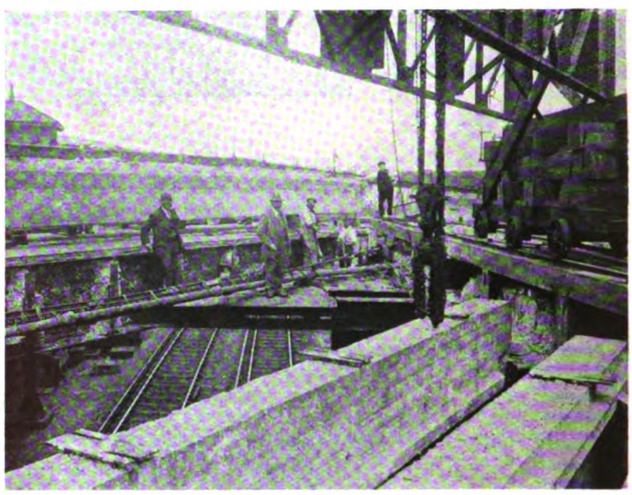

Fig. 4.—St. John's Hill Bridge—Showing a Ferro-concrete Beam Just Lowered.

the permissible deflection specified. The bridge was tested and opened by the Mayor on May 28, 1914.

A third, and still more important bridge, is that at Clapham Junction over two tracks of the London and South Western Railway; it is one of the spans of St. John's Hill bridge, carrying the Wandsworth Road and its tramway over the many railway lines at that

Fig. 5.—St. John's Hill Bridge—Showing Gantry Used to Place Ferro-concrete Beams in Position.

station. St. John's Hill forms with Lavender Hill a continuation of Wandsworth Road, connecting at its western end with East Hill and High Street, Wandsworth. This is the first reinforced concrete bridge constructed for the London County Council, and is also

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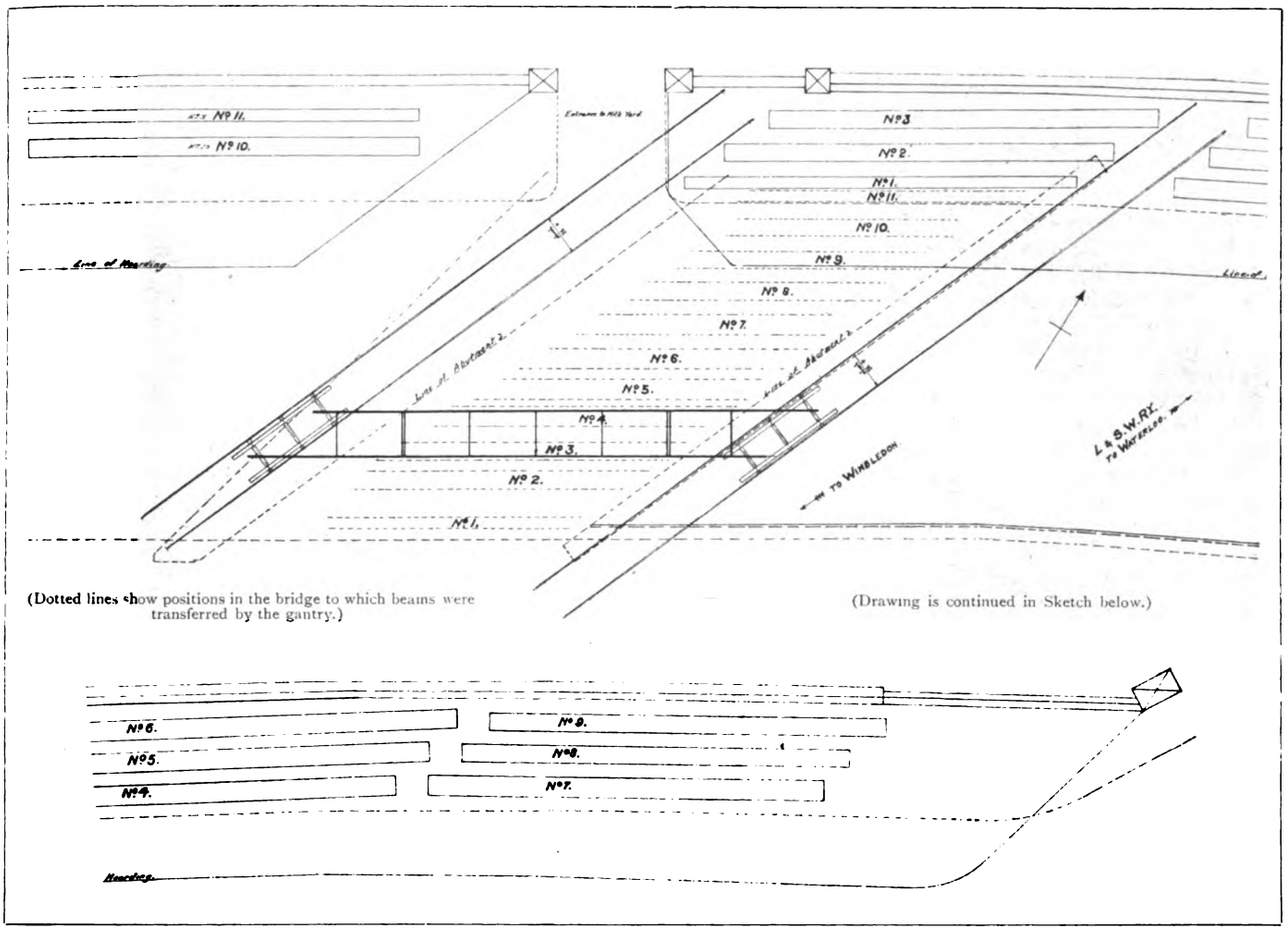


(Dotted lines show positions in the bridge to which beams were transferred by the gantry.)

(Drawing is continued in Sketch below.)

**Fig. 6.—Lay-out of Concrete Beams during Casting and Gantry Run.**

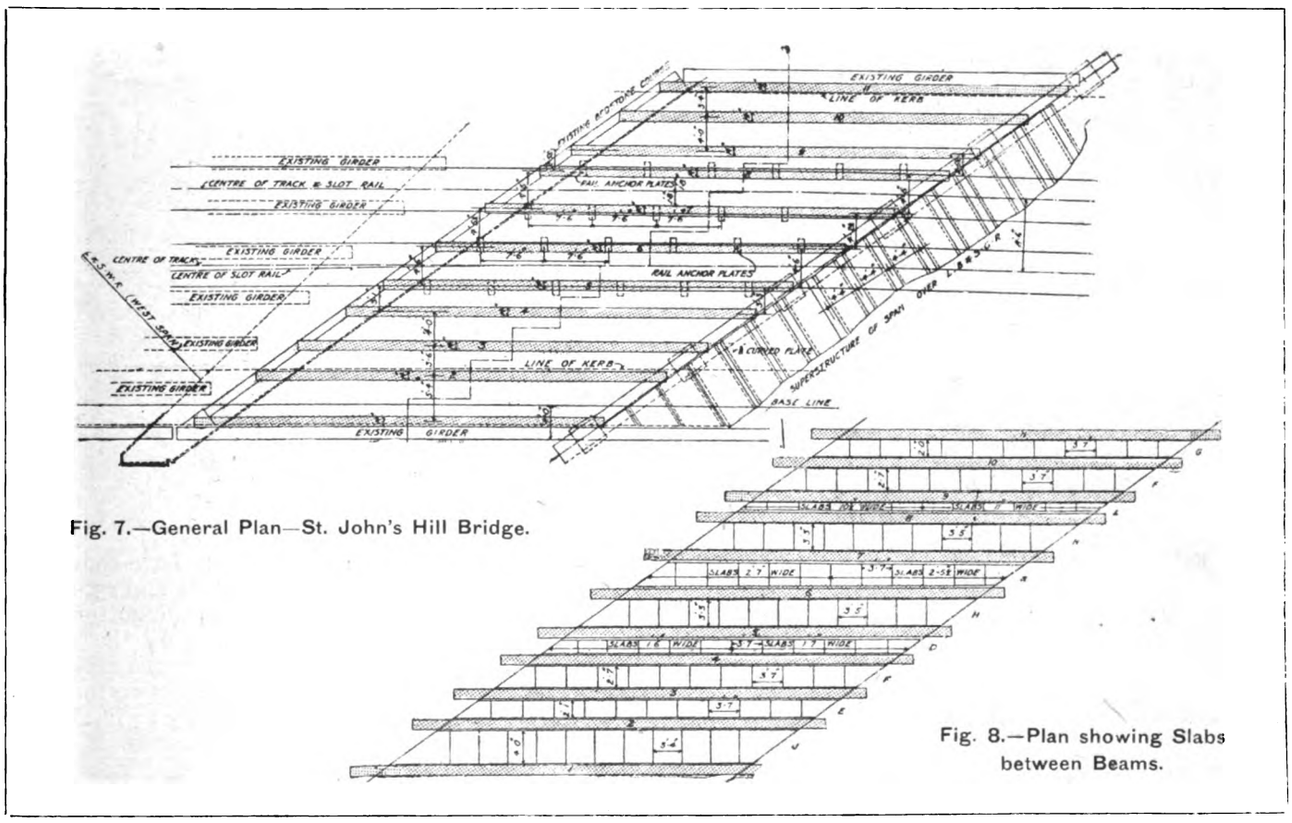


Fig. 7.—General Plan—St. John's Hill Bridge.

Fig. 8.—Plan showing Slabs between Beams.

**St. John's Hill Bridge, Clapham Junction.**

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original in that the parts of the superstructure were not moulded in place but were "pre-casted." This moulding of parts before placing them in position possesses several advantages, and is being rapidly adopted in many places. It ensures closer supervision when the work is an extensive one, and consequently better and more reliable quality, an important factor in all ferro-concrete structures. Moreover, it enables the parts to be placed in position ready to bear their respective loads, and therefore with a minimum of delay after the structure has been made ready for them. This advantage was of supreme importance in the work under review; for an old superstructure had to be replaced by a new one with as little delay and inconvenience as possible to the important traffic over it, and where no false work could be erected on the running lines underneath, so that everything had to be done from above. The converted span of the bridge consisted of steel girders and decking crossing the rails at an angle of 34 deg. Half the superstructure under one track of tramrails was converted at a time. The necessary diversions of the rails and street traffic at each end of the span left a space which was utilised as a yard in which the girders, slabs, and decking were all moulded and seasoned. while the old work was being removed. The span is about 50 ft. long, on the skew, and 32 ft. 6 in. wide—with a double tramway line and a new footpath 6 ft. 6 in. wide on one side, the old path, lately reconstructed, being left on the other. The superstructure (Figs. 7 and 8) consists of eleven ferro-concrete beams 48 ft. long, 3 ft. 7 in. deep, 26 in. wide near the top, and 16 in. at the bottom (Figs. 9 to 13). At the west end the main beams rest on the old bedstone course; at the east end they are carried by a stringer steel girder forming part of the bridge over the London, Brighton and South Coast Railway. The beams are rebated at the top to receive the slabs. These vary in width according to their position, as shown in the plan in Fig. 8; they are 3 to 4 in. deep, and the whole floor is covered with a 2-in. coat of reinforced concrete. The bars are embedded in the concrete, and rails are bolted to the plates with a half-inch teak packing in between. The tramrails are anchored to the main beams as shown in Fig. 9. The roadway, with the granite kerbs and the 3-in. York stone sidewalks, is formed on top of the covering coat, and is paved with 5-in. wood blocks.

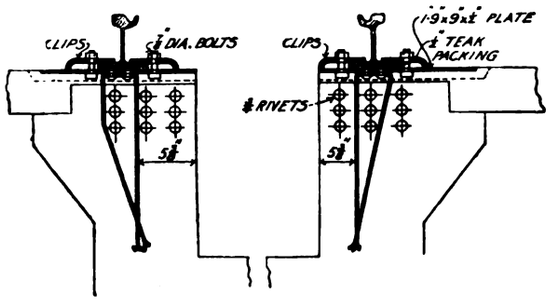


Fig. 9.—Anchorage for Tram Rails.

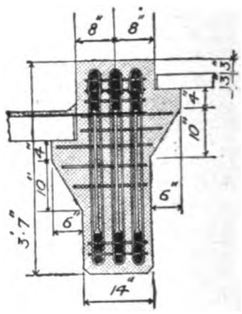

Fig. 10.—Main Beam Section.

The main beams are amply reinforced by longitudinal bars, the number of which varies slightly with the calculated bending moments, as seen in Figs. 11 and 12. The bars are securely anchored at the ends, and the web stresses are taken up by the diagonally bent-up ends and by the vertical stirrups and transverse bars. The reinforcement of the slabs and of the top covering present no special features. Three ferro-concrete conduits are provided, as shown in Figs. 12 and 13. The sides are formed by the main beam, and the bottom by reinforced slabs supported by brackets on the sides of the beams. The conduit on the left, for the different mains, is 4 ft. wide by 16 in. deep. The two for the tramline conductors are 3 ft. 4 in. wide by 27 in. deep.

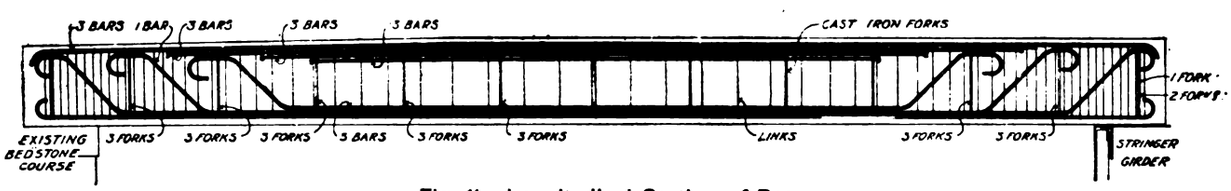


Fig. 11.—Longitudinal Section of Beam.

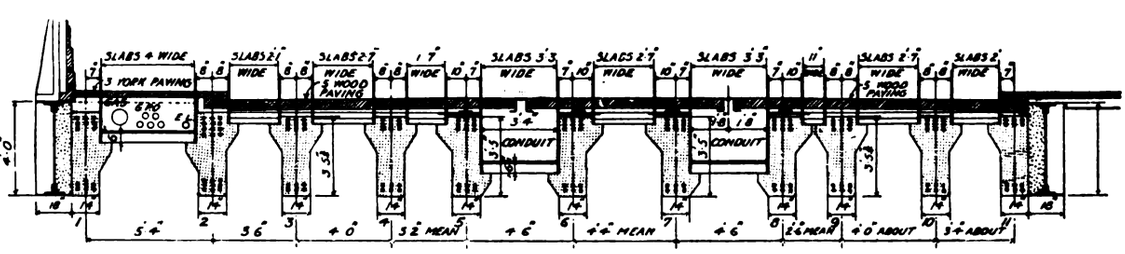


Fig. 12.—Section A A on General Plan, Fig. 7.

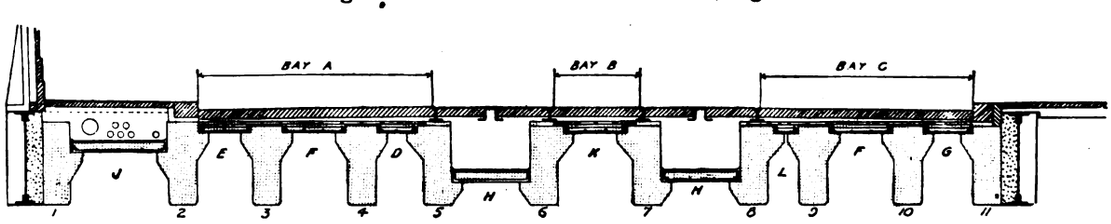


Fig. 13.—Section showing Beam Slabs and Conduits.

The work was started by the contractors, Messrs. Holloway Brothers (London), Limited, Grosvenor Road, in February, 1917, their engineer, Mr. W. H. Stacey, having charge of the work. Messrs. Holloway Brothers prepared a special travelling gantry for

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handling the 15-ton girders. This runs on two six-wheel trucks, as shown in Fig. 5, and the general lay-out can be plainly seen on the plan, Fig. 6. When the first lot of beams had been placed in position the hoarding was shifted across the road, which was entirely blocked while the last beams were lowered into position. These were brought up to this place by mounting them on little lorries and hauling them along by a chain and tackle. On the lay-out plan the beams in full lines show where they were cast, and the dotted lines with similar numbers where they were eventually placed.

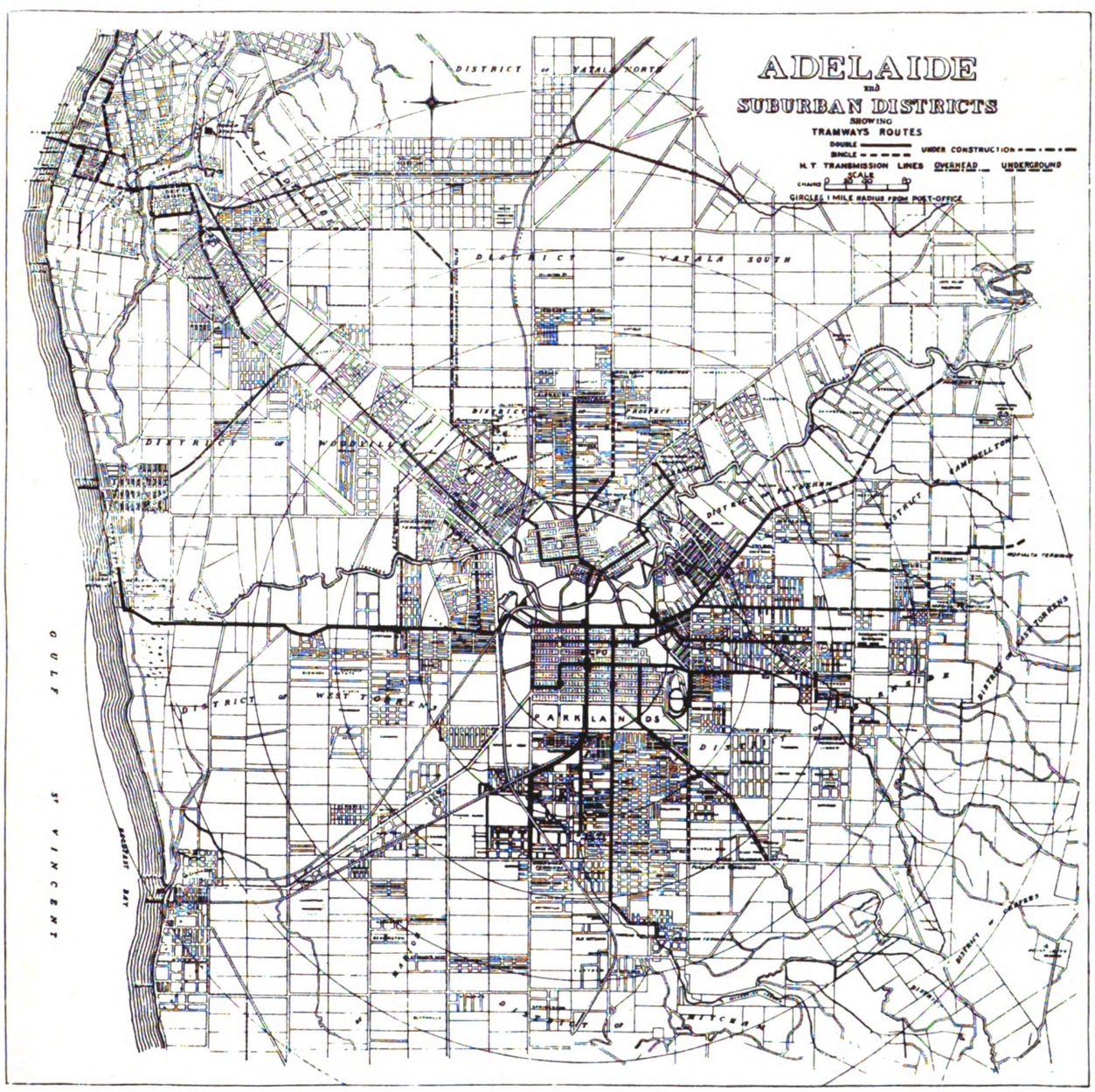
The ferro-concrete details were worked out by Messrs. L. G. Mouchel and Partners, Limited. The chief engineer of the London County Council, Mr. G. W. Humphreys, M.Inst.C.E., was the responsible officer, and his assistants were Messrs. W. C. Copperthwaite, M.Inst.C.E., and C. Beecher. The structure was thoroughly tested with highly satisfactory results on July 15, 1917. The test load consisted of two 20-ton service vans, close coupled, on the tramway line over beams 5 and 6. A sensitive deflectometer registered only 4 mm., and the vibrometer showed no vibration but only a gradual deflection.

## ADELAIDE MUNICIPAL TRAMWAYS.

It is now some years since the Adelaide Municipal Tramways Trust came into existence, but it was not till October, 1914, that the last horse-car disappeared and electric traction became universal. The system, as will be seen from the accompanying map, includes some long suburban lines. Last year the total route length was 54½ miles, of which 34½ miles are double track and 20 miles single. Additional lines were under construction.

The financial year of the Adelaide Tramways Trust ends on July 31, so that the figures for the past year are not yet available. Those for the year ended July, 1916, are of interest, and the revenue showed substantial increases when compared with previous years. The gross earnings were £322,759, while the working expenses were £193,965, or 60 per cent. of the revenue. This was the lowest ratio on record for the undertaking. The revenue was earned with a stock of 170 cars, from which it may be inferred that on some of the routes a comparatively infrequent service is necessary.

As in "new" countries generally, the cost of most things is higher than it is at home. It is consequently

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not surprising to find that for the year ended July, 1916, the receipts equalled 16·367d. per car-mile, while the working expenses stood at 9·866d.

Mr. W. G. T. Goodman, who is now on a visit to this country, has been the general manager and chief engineer of the undertaking since its inception, and was responsible for the whole of its equipment, including track, power installation, and rolling stock. The electric tramway system which he has gradually built up is not only a credit to himself personally, but is an enterprise that is of immense importance to the city, and proves how thoroughly the authorities of Adelaide are dealing with their transport question.

In a later issue we hope to describe the undertaking in detail, but we may here touch on a few points that are of particular interest at the present time. Like other tramways the world over, the undertaking has suffered a good deal from rail corrugation, and appropriately enough that Australian invention which is proving of such service at the present juncture in this country, the Woods-Gilbert rail planer, was employed to remove the evil. At that time (1915) the ingenious machine was little known in this country. Down to the middle of last year some 100,000 feet of rail on the Adelaide tramways had corrugations removed by the Woods-Gilbert machines, and Mr. Goodman reported that their use had obviated the necessity of re-laying a considerable length of track.

The last report, which covers a period of two years, refers among other things to considerable additions to sub-station plant required by developments of the system. A peculiar feature is the fact that the reserve for renewals is statutory, a percentage having to be set apart annually to the fund. Another interesting item is to be found in agreements with the Harbours Board and the Commissioners of Waterworks (which are Government departments) for the supply of electric power to their workshops.

The attempts which have been made to establish motor omnibus services in Adelaide have not yet been successful. The Trust ordered some of Daimler make in July, 1914, but owing to war work the Daimler Company could not give delivery, and the contract was cancelled. A motor omnibus company started operations in 1915, but owing to lack of support it was forced into liquidation, and the vehicles were withdrawn in March, 1916.

Adelaide tramway staff at the time of the report numbered 1,130. The high sense of national duty shown by the whole service was very gratifying. The generous action of the Trust in making up the difference between military pay and the rates paid in the tramway service proved a great stimulus to the recruiting movement.

## GOODS TRAFFIC ON TRAMWAYS.

Councillor Cheetham, chairman of Oldham Tramways Committee, has reported to that body on several points raised at the Municipal Tramways Conference. In reference to the carriage of goods by tramways, Mr. P. Priestly, the general manager, said that in Oldham it would probably mean the laying of new lengths of rail and the provision of suitable vehicles. He had gone into the matter in regard to one or two industries, and had formed the conclusion that it would be possible to cultivate a tremendous amount of new traffic along the lines hinted at. The chairman said that if the tramways could secure the carrying of a considerable part of the merchandise from Manchester to Oldham a saving would be made in the cost of repairing the roads, which were damaged by heavy motor vehicles.

Dundee Tramways Committee have considered representations made by Mr. Peter Fisher, general manager, on the result of the discussion on goods carriage at the Municipal Tramways Conference. Mr. Fisher put the two governing facts of the question as follows :—(1) That electric haulage can be effected at a third of the cost of horse haulage ; (2) that most of the equipment for it exists and lies idle during a large part of the day, which means a waste of capital expenditure.

## MAKING A MOTORMAN OUT OF AN ENGINE-DRIVER.

In the United States that important and highly skilled workman whom we call a railway engine driver is described as a locomotive engineer. Hence the title of an interesting paper, "Making an Electric Locomotive Engineer out of a Steam Locomotive Engineer," by Mr. W. F. Coors, which appears in the American *General Electric Review*. Mr. Coors is a member of the staff of the railway and traction engineering department of the General Electric Company, and has had much experience of the process of changing men from being drivers of steam trains to drivers of electric trains. Some English railway companies which have converted parts of their lines from steam to electric traction have had similar experience, but generally in their case multiple-unit electric trains are used instead of electric locomotives. As is well known, some of the latter now running in America are more powerful than any steam locomotive. After the war, if we then extend railway electrification, the electric locomotive may be more largely used in this country than it now is. Meantime the following summary of Mr. Coors' article cannot fail to be interesting.

In the case of conversion from steam to electric traction, as soon as the electric locomotives are in operation all objection by the engine crews to heavy trains ceases, there being no difference in their work whether they have forty or a hundred cars in a train. Under steam operation methods the locomotives may be changed every division of 110 miles. But when the motors take hold of a train they stay with it for at least two divisions, and the crews make a "main line change" at the intermediate division point. The running time over the old divisions may be shortened from twelve to eight hours, and so even the crews may look favourably on the motors.

Many of the train operating men are sceptical about their chances of escape in case of a wreck when the trolley wire may get down on the ground or cars and electrocute the whole personnel, leaving the train to run wild. This condition looks easily impossible to the electrical engineer, but it is not easy to explain away from the minds of men who have never had any experience with electricity. From this standpoint alone the old operatives are preferable to men who have had a little experience with low-voltage circuits, just enough to be foolhardy with higher voltage. The steam men know nothing about "juice"; they admit it and are ready to go to extreme precautions before undertaking the handling of any electric apparatus whether energised or not.

It is significant that in a recent large electrification only a few serious accidents have occurred, and that none of these has happened to the men operating the trains : the very men, in fact, who had never handled electric energy before, and who perhaps have the major part of this work to do in actual operation. Pantographs have been wrecked and tangled in the overhead work, steam locomotives have caught and torn down the wire, snow slides have taken out long stretches of pole-line, and, in rare instances, the wire has broken and dragged on the roofs of the steel passenger cars ; yet with all these troubles nothing more than a slight scare of the witnesses has occurred.

It was a little difficult for the engineers to realise just how important the trolley wire and pantographs were, until they had an accident or two involving these equipments. In the early stage of their learning they were intent on the operation of the locomotive only, and if they were headed by a careless switchman

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into a track which had no trolley wire it was ten chances to one that they would take the signal and back right into it only to discover that they had a dead motor and couldn't get back to the wire again, or the pantograph had been caught and smashed against the overhead span wires. However, with a little experience of this kind it soon became second nature for the men to watch the trolley wire almost as much as the track.

The men have been instructed never to go on top of the locomotives or to open any covers over electrical apparatus in the locomotive with either of the pantograph current collectors up against the wire. Each locomotive is equipped with a long pole hook and dry rope which can be used to pull a pantograph out of a wire entanglement, and in rarely bad cases the power is cut off at the sub-stations by request from a portable set attached to the despatcher's telephone circuit and the line grounded at the motor. Since there are two pantographs on each machine, it is comparatively easy to disconnect one which is damaged and to use the other one in operation. The trouble from this cause rarely occasions a delay of more than thirty minutes.

On the electric locomotive the engineer is located at the "front of things," and many of the men at first wondered what would be left of them in case of a head-on collision. Several accidents, in which with steam engines the men admit their chances would have been slim, have demonstrated that the electric locomotive cab construction and arrangement take very good care of them in such emergencies. The unobstructed front view not only gives the men a chance for earlier warning and more time to apply air brakes at the prospect of a coming collision, but also they can take steps "to unload" themselves, and get out of danger. There have been cases where these machines have run into landslides and rolled down embankments without injuring the men at all. There are no steam-pipes to burst, no red-hot fire-boxes with gas and smoke to overwhelm the men, and no tender with flying coal to crash into the cab.

The operating men on this electrification regard the whole arrangement as a success. The shorter working hours, the cleanliness of the surroundings at work, little on the locomotive requiring close attention, less danger involved, no anxiety as to whether they have enough coal or water, increase in pay, and confidence in the equipment through a thorough knowledge of its operating details, have won many friends to the electric locomotives from the men who use them. The men were very receptive of all instructions given them.

The first division was put under electric operation as soon as several motors arrived from the factory. Men were sent out by the manufacturer as instructors to ride with each and every new engineer until he should be sufficiently qualified to operate alone. The factory men were called out by the regular call-boy who summoned the train crews to duty. Lists of men who were "qualified" by the instructors were posted in all conspicuous places. It cannot be said that the younger men were exclusively able to qualify quicker than the older ones, but such was generally true. However, from an instructor's point of view, when one of the older men did express his confidence in himself, and showed sufficient progression, there was no need to worry about him later, while the men who had recently been "set up" from firing were likely enough to call for help over the dispatcher's telephone when out in the middle of their run.

Since the air brakes were practically identical to those used in steam practice, this feature tended towards greater confidence in the engineer.

On the succeeding three divisions, instruction work was much easier. The men would talk over the new machines among themselves, and their various experiences with each particular feature, so that much instruction work could be briefly passed over. The railway company placed a "caboose" at the instructor's disposal at terminals for an instruction car, and the men after being out on the road were very willing to drop in for a few minutes to talk and become acquainted with the motor blue-print wiring diagrams, and learn just what operation details were necessarily required. Later, instruction books were prepared and distributed to each engineer for home study, and to their credit it may be said that the books proved to be a valuable aid to the instructors, who it seemed at first had tackled an endless job. By these means the period of actual road instruction per man was cut down from one to two weeks to a maximum of five days, and in many cases to only two days.

Passenger engine crews were given more work in learning than the freight men, since on through-runs there was little opportunity to show up the "fine" points to be learned. These men usually had a half-day off every other day, and came to the round-house, where an instructor would purposely remove fuses on a spare locomotive, put match stems in the relays, and cause a multitude of troubles for the engineers to locate and remedy.

The technical terms used by the electrical engineer for apparatus and electrical quantities are readily taken up by the steam man where they are not confusing or where one term for the same thing is strictly adhered to. It is easy to explain the difference between kilowatts and kilowatt-hours to the beginner, but the various indefinite distinctions *drawn* by technical men between potential, tension, and voltage—for example, when referring to electric pressure—are not readily received by operating men who are told that such pressure is measured in *volts*, and who therefore are prone to conclude that the proper term should be "voltage" and that exclusively. While water and air pipe analogies are useful in explaining direct-current actions, they fail on practical hearers when alternating current is dealt with. Steam, water, and air valves when *open* permit the flow of current, while electric switches and contactors permit the flow of current when *closed*; so the old steam man must be excused sometimes if he wonders what a set of instructions or wiring diagrams mean if these terms are used indiscriminately or if they sometimes allude to con-contactors as *switches* or relays as *regulators* depending on the purpose for which they are utilised. He can only judge from the external appearances when beginning, and if such a piece of apparatus on the electric locomotive is called one thing in one location, and a similar affair is called something entirely different when in another location, it can only mean an extended length of time before the steam locomotive engineer can become qualified for electric locomotive operation.

**Successful Fare Revision at Croydon.**—Mr. T. B. Goodyer, manager of Croydon Corporation tramways, has presented to the Council a report on the financial working of the new fare stages. The increase in the figures for the year ended August 12, 1917, compared with the average figures for the four preceding years, is as follows:—

| | Increase. | Per cent. |
|---|---|---|
| Gross receipts ... ... ... ... | £11,728 | 13·33 |
| Receipts per car-mile ... ... ... | 3·01d. | 37·72 |
| Number of passengers ... ... ... | 928,416 | 4·67 |
| Average fare per passenger ... ... | ·088d. | 8·28 |

In the special report submitted to the Council on July 3, 1916, it was estimated that the revised charges would produce an increase in gross revenue of at least 8 per cent. The annual increase of 13·33 per cent., as set out above, is a result which the Council will no doubt regard as thoroughly satisfactory.



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THE
# Tramway and Railway World

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LONDON, NOVEMBER 15, 1917.

**The Dover Accident.**

Tramway authorities and members of Military Tribunals ought specially to note two statements in the report of Colonel Pringle on the Dover accident. The first is that the motorman was discharged from the army owing to a nervous breakdown, and that in the judgment of Colonel Pringle such a man is unlikely two months later to be fit to drive a car on a difficult route. At all events, adds the inspector, medical evidence should be sought before candidates of this description are accepted. The case emphasises the contention widely held before the war that there should be a medical examination of every man who seeks to become the driver of a public vehicle. This wise provision already obtains in some of the more important undertakings. Apparently with the idea of making some concession on account of the impossibility of obtaining suitable men at this juncture, the inspector limits his remark to those who are to be employed on difficult routes. This would seem to indicate a belief that men discharged for the reason referred to are not altogether unsuitable, but with the Dover mishap in mind managers would be well advised if they leave the question to the decision of a medical man. They will gain no help from a perusal of last year's Report of the Home Office Committee on the subject of utilising partially disabled men as drivers of tramcars and omnibuses. The question of nervous disability did not enter into the Committee's deliberations, which were concerned solely with deficiencies in limbs. A man's behaviour during his period of training may not in every case settle the question whether he will be able to retain his nerve in an emergency. Many a driver who has never gone through the nerve-shattering experiences of soldiers at the front has lost his self-possession in circumstances similar to those of the Dover accident. The failure in that case may have been to some extent due to the driver's unfamiliarity with the rheostatic brake, which it appears he had only used on one occasion. Upon this point Colonel Pringle makes a representation that calls for attention on the part of managers. The other observation to which reference may be made is the inspector's expression of doubt as to whether Tribunals are aware of the difficulties of finding suitable substitutes for motormen who are taken for the army. That remark might be brought to the attention of the new Director of National Service by the Tramways Associations. Another desirable step is that the Board of Trade should consult with the specialists who have the care of soldiers whose nerves have been shattered, and in such consultation Sir John Collie, consulting physician to the London County Council, might be included.

**Safety First—A Mistaken Attitude.**

Two weeks hence the London Safety First Council complete their first year of existence. In briefly reviewing the formation and work of the Council, several considerations claim attention. The first is the providential aspect of the movement at a period when the restricted lighting had increased the dangers of the streets. The fatalities arising therefrom in London alone before the war had exceeded the annual aggregate of air raid deaths for the whole country, as the Home Office have pointed out. In any other European country an ameliorative movement would doubtless have come from an official department, but it is customary for Britons to work out their own salvation in matters affecting

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the public weal. In this instance, however, the Local Government Board must be given credit for assisting by their permission to the Metropolitan local authorities to aid the movement financially to the extent of five pounds per annum. To attempt to launch the scheme required the initiative of a man of enthusiasm at a period of unprecedented difficulty; one who could speak with the knowledge of experience of what such a movement would be likely to achieve. The pioneer was forthcoming in the operating manager of the Underground Railways and Omnibus Company. Mr. H. E. Blain had several years before introduced a safety movement for the latter undertaking and for the elementary schools on a scale surpassing in thoroughness and results any work of this nature outside of the United States. A cynic might suggest that Mr. Blain was astutely inducing the public to bear the cost of preventing accidents largely due to omnibuses. That argument cannot be sustained, for the company have proved that their safety work has been a profitable investment. As Mr. Blain remarked at the Municipal Tramways Conference this year, when he was appointed to the L.G.O.C. the amount expended on accident claims was almost phenomenal, but in four years these costs have been reduced by £55,000 a year. It is interesting to learn that in analysing the claims the company found that if the rule of the footpath had been reversed, in all probability three-quarters of the fatal accidents would have been avoided. This reminder of the cause and source of origin of the movement for changing the rule of the footpath will be useful to the local authorities who are considering the question of supporting the propaganda. Omnibuses are not the only vehicles by which persons are run down if they incautiously step from the pavement under the present regulation of keep to the left. Mr. Blain would not have been worthy of his trust, either to the company or indirectly to the public, if he had failed to make an attempt to broaden the basis of the safety movement. Undeniably it is an advantage to the community to have the work carried on by a semi-public body representative of local authorities and of public and private vehicular interests. Its effect must undoubtedly be to lessen the vital and monetary losses, to say nothing of physical suffering, entailed by street accidents. One of the most pleasing aspects of the Safety First Council was the inclusion thereon of representatives of the employees' trade unions, as well as the managers and administrators of traction undertakings. It is pleasing, too, to record that the public carriage departments of the City and Metropolitan Police recognise their duty to the public by sending representatives to the meetings. What explanation, then, can be given for the absence of the London County Council? The cause is due to a mistaken attitude. So notable was the lack of representation of the London County Council at the inaugural meeting that a question was asked upon the point. In reply the meeting was informed that the Clerk had written that while the County Council were in sympathy with the object in view, they felt diffidence as an executive body in sending representatives. Truly a lame excuse. If the same idea had animated the borough and urban councils and the police there would have been no Safety First Council, for they are all executive bodies. In view of the large sum the Council have to pay as compensation for accidents they would be well advised to reconsider their position, which certainly does not receive the support of the Local Government Board, for that body was represented at the inaugural meeting.

**Engineering Training.** The Institution of Civil Engineers has always taken an active part in the training of engineers, especially of mechanical engineers. What applies to the training of engineers applies equally to many other occupations, especially the question of educating what Sir John Wolf Barry calls "the rank and file." Tramway and railway undertakings employ a large body of these, and the training of their boys after they leave school is a matter almost entirely in the hands of their parents. These same working men have altered enormously of late years, and necessarily so. The absolutely unskilled labourer, who depends entirely on his thews and sinews, and who has only use for a modicum of brains, is becoming more and more scarce in civilised countries. Brute force is of little use in electrically-operated work, and machines are more and more taking the place of purely manual labour. Under

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these circumstances the working man parent finds it difficult to bring up his progeny in his own line of work, where his experience and his connections would be invaluable to his family. He simply cannot afford to keep them while they are learning their trade practically, nor are there many opportunities of introducing and training boys into workshops and on works generally. This difficulty is mainly due to the want of sympathetic co-operation and co-ordination between masters and men. Moreover, even if the lad be welcomed and assisted by the other workmen, manufacturing firms do not like to initiate them in all the specialities of their work unless there is a certainty of their not taking this knowledge elsewhere. Again, there is the thin-veiled antagonism between teachers and practical men; the professors too often look down on the latter as ignoramuses, while the man who does the work is too often irritated by the superiority claimed by college-trained experts. A meeting was held in the theatre of the Institution of Civil Engineers on October 25 at which Sir Maurice Fitzmaurice, who has just vacated the presidential chair, presided. This meeting was the last of a series extending over forty years which have resulted in fairly good provision for the education of the "officers' training corps of engineering." Although the "rank and file" were not mentioned by any of the speakers or in the resolutions passed, those responsible for calling the meeting are so well known to have the welfare of the rising generation at heart that some attempt is sure to be made to find a seat at the round table, at which engineers, manufacturers, and professors are to be invited to confer, for representatives of the workmen, the foremen, shop stewards, and elementary teachers upon whom the actual managing of the rising generation would ultimately devolve. The meeting on October 25, as stated by the chairman, was the most important and representative that had ever taken place in the Institution. The gathering was preceded by a conference attended by nineteen influential men who had decided to call it together, and who drew up the resolution that was passed thereat. The meeting was convened by Mr. A. E. Berriman, chief engineer of the Daimler Company, and Mr. A. P. M. Fleming, of the British Westinghouse Company. It was resolved to appoint a committee to consider some form of central organisation for the improvement and better co-ordination of engineering training. Among those who attended were delegates from 25 technical institutions and societies, from 30 technical bodies, and from 11 Government offices. No Mechanics' Institute was represented, nor anyone from such bodies as the Institute of Locomotive Engineers and the Permanent Way Institution.

## MAINTENANCE AND LABOUR FOR TRAMWAYS.

### Representative Committee to be Appointed.

On the invitation of the President of the Board of Trade, a meeting of representatives of the Municipal Tramways Association and of the Tramways and Light Railways Association with representatives of the Board of Trade and of the Ministry of Munitions, was held on Nov. 2 at the offices of the Board of Trade, Whitehall Gardens, for the purpose of considering the position of tramway undertakings in the matter of shortage of materials and labour, with special reference to the needs of those undertakings which are engaged in conveying persons occupied on work of national importance. Sir Albert Stanley was accompanied by Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions. The President of the Board of Trade stated that the position of matters was becoming so acute that the Board of Trade and the Ministry of Munitions thought it necessary to make some arrangement so that instead of having two departments, namely, the Board of Trade and the Ministry of Munitions, dealing with the subject, it could be attended to by one separate body. He invited the co-operation of the two tramway associations, which was gladly promised, and he said that he would be pleased to receive suggestions as to the best methods of carrying out the scheme. He announced that Mr. James Devonshire had been appointed controller of the scheme.

The Board of Trade have obtained full particulars of the work that is being done by the tramways, including the number of munition works which are served. These have greatly increased in number during the past year.

### Official Statement.

On November 10, the Board issued the following statement:—In view of the difficulty in meeting the demands for materials and labour required for the maintenance and renewal of the permanent way and rolling stock of tramway undertakings, the Board of Trade are appointing a committee to consider the needs of these undertakings so that the necessary steps may be taken to supply, as far as possible, such needs, even though it may be at some temporary sacrifice to less essential undertakings. The Municipal Tramways Association and the Tramways and Light Railways Association are being invited to nominate members to the committee, and the Board have asked the London County Council to allow Mr. A. L. C. Fell, the manager of their tramways, to serve on it. Mr. James Devonshire has been invited to be chairman of the committee. It is not intended that the control of tramway undertakings should be interfered with by the committee.

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# CHARGES FOR POWER FOR TRAMWAYS.

## The Effect of War Conditions.

Most of the municipal tramways in this country buy electrical energy from the electricity departments of their Corporations. In the past there have naturally been disputes between those departments, the electricity committee wanting a good price so as to be able to present favourable accounts, especially where the lighting part of the business was run at a loss. The tramway department, on the other hand, wished to have the energy at as low a figure as possible, so as to aid in keeping down the working expenses of the tramways. Compromises or agreements were arrived at, and for some time before the war something like definite bases of charge had been reached, the price per unit varying with the cost of coal in the locality and with other local circumstances. After the war had been in progress for some time, the electricity undertakings began to feel the effect of the gradual increase in the price of coal and other supplies, and also of the rise in wages. Sooner or later, therefore, the demand had to come for a higher price for electricity from all consumers, and the tramways were not made an exception to the rule. It is true that for reasons which are probably peculiar to the localities, there are still a number of places in the country where no increased charge has been made for electricity for tramways, as compared with the pre-war days. In the great majority of cases, however, there have been increases.

The managers of those municipal tramway undertakings which do not own the power stations have kindly given the prices per Board of Trade unit charged to the tramways by the electricity departments before the war and the prices now, and the particulars are set out in the accompanying table. As will be seen, 47 undertakings report increases. These increases run from about 10 per cent. up to as much as 40 per cent. In any examination of the table, the local conditions must, of course, be taken into account, and among these, beside the price of coal, is the load factor on the power station apart from the tramway load. It may be hoped that if the Coal Controller succeeds in preventing any further substantial increase in the price of coal, it will not be necessary to raise the charges for electricity much more, except so far as may be necessary to meet further increases of wages.

The tramway managers in fourteen towns inform us that there has been no increase in the charge for power, but in some of these cases an early increase is anticipated.

| Town. | Pre-War Rate. | Present Rate. |
|---|---|---|
| Accrington ... ... | 1·23d. | 2·25d. |
| Ashton-under-Lyne | 1·25d. | 1·6d. |
| Ayr ... ... ... | 1½d. first 200,000 units and 1d. above | 1·87d. first 200,000 units and 1·25d above |
| Birmingham ... | 1·125d. (on a minimum of 18 million units per annum) | 1·125d. plus ·015d. for every 6d. increase in price of coal per ton above 9s. |
| Blackburn ... ... | 1·3d. | 1·495d. |
| Blackpool ... ... | 1·6d. | 1·76d. |
| Brighton ... ... | 1·2d. | 1·4d. |
| Burnley ... ... | 1·2d. | 1·25d. |
| Burton-on-Trent ... | 2d. first 100,000 units and 1¼d. above | 2·3d. first 100,000 units and 1·437d. above |
| Bury ... ... | 1d. | 1·15d. |
| Chester ... ... | 1·33d. | 1·506d. |
| Colchester ... ... | 1½d. | 1⅝d. |
| Croydon ... ... | 2d. first 1,000,000 units, 1½d. second 1,000,000, and 1d. above | 2d. first 1,000,000 1¾d. second units, 1,000,000, and 1¾d. above |
| Darwen ... ... | 1·28d. | 1·4625d. |
| Derby ... ... | 1·45d. | 1·595d. |
| Doncaster ... ... | 1·25d. | 1·5625d. |
| Dundee ... ... | 1d. | 1·1687d. |
| East Ham ... ... | 1·0625d. | 1·1687d. |
| Gloucester ... ... | 1d. | 1·333d. |
| Great Yarmouth ... | 1·5d. | 1·65d. |
| Halifax ... ... | 1⅛d. | 1¼d. |
| Ilford ... ... | 1 1/16d. | 1⅜d. |
| Ipswich ... ... | 1¼d. | 1·875d. |
| Kirkcaldy ... ... | 1d. | 1⅛d. |
| Lancaster ... ... | 1·7d. | 1·9d. |
| Leith ... ... | 1·001d. | 1·5673d. |
| Leyton ... ... | 1¼d. first 1,500,000 units, 1d. next 300,000, and ¾d. above | 1·3125d. first 1,500,000 units, 1·05d. next 300,000, and ·7875d. above |
| Liverpool ... ... | 1·13d. | 1·204d. |
| Maidstone ... ... | 1·125d. | 1·5d. |
| Manchester ... | 1·026d. | 1·1483d. |
| Newport ... | 1·35d. first 1,000,000 units, and 1d. above | 1·755d. first 1,000,000 units, and 1·3d. above |
| Nottingham ... | 1·25d. | 1·406d. |
| Plymouth ... ... | 1¾d. first 750,000 units, and 1½d. above | 1·56d. |
| Rawtenstall ... | 1¼d. | 1·375d. |
| Rochdale ... ... | 1d. | 1·25d. |
| Southampton ... | 1⅜d. | 1·787d. |
| Southend ... ... | 1·75d. | 2d. |
| Stockport ... ... | ·513d. | ·536d. |
| Swindon ... ... | 1·25d. | 1·375d. |
| Walsall ... ... | 1·68d. | 2·352d. |
| Walthamstow ... | 1·375d. | 1·394d. |
| Warrington ... | 1½d. | 1·725d. |
| West Ham ... ... | ·75d. | ·91d. |
| West Hartlepool ... | ·75d. | 1·15d. |
| Wigan ... ... | 1·188d. | 1·25d. |
| Wolverhampton ... | 1d. | 1·3d. |
| York ... ... | 1·25d. | 1·375d. |

**Burton-on-Trent Corporation Tramways.**—The Tramways Committee estimate that there will be a deficiency of £2,660 for the current year if there are no further increases in the cost of materials or wages. Transfer tickets have been abolished, but the proposed increase in fares has been suspended for six months.

**Electric Power Supply Committee.**—In reply to a question asked the President of the Board of Trade in the House of Commons on November 7, Mr. Wardle said that the Departmental Committee on Electric Power Supply had not yet presented a report, and he could not say at present when it would be able to do so. In view of the great importance of the subject there would, however, be no avoidable delay.

**Irish Light Railways and Tramways Act.**—In the House of Commons, the Chief Secretary for Ireland informed Mr. Byrne that schemes under the Tramways (Ireland) Act required the approval of the County Councils concerned, which must be given at two quarterly meetings. Under Section 43 of the Tramways (Ireland) Act of 1860 mansion houses, demesnes, etc., could not be acquired without consent of owners, but by Section 5 of the Light Railways (Ireland) Act, 1889, an order of the Lord Lieutenant might provide that Section 43 of the Act of 1860 shall not apply. The railway under consideration for the development of collieries was authorised by the Defence of the Realm Regulations.



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# MUNICIPAL TRAMWAYS AND WAR.

## ALLOWANCES, BONUSES, NUMBERS OF MEN WHO HAVE JOINED THE COLOURS, Etc.

The Municipal Tramways Association have issued an elaborate series of tables containing the results of replies to queries addressed to the municipal tramway authorities as to allowances to dependants, war bonuses, enlistments, employment of women, auxiliary drivers, etc. For convenience of reproduction we have taken the two columns containing the greatest amount of reading matter out of the tables and printed their contents in paragraph form. The other columns stand in tabular form as in the original. The smaller table is a summary of the details in the longer tables. They constitute a fine record both for employers and employed. The tables were compiled from information supplied in August, and some important changes have since taken place.

### ALLOWANCES TO DEPENDANTS OF EMPLOYEES WHO HAVE JOINED THE COLOURS.

(*a*) *In the case of married men.*
(*b*) *In the case of single men.*

ABERDARE.

(*a*) 10s. per week for wife, and 1s. per week for each child.
(*b*) Each case considered, and if deserving, 10s. per week to dependant father or mother.

ABERDEEN.

(*a*) Difference in pay made up by the Corporation.
(*b*) Difference in pay made up by the Corporation.

ACCRINGTON.

(*a*) Up to May, 1915, half wages granted to dependants. Since that date each case dealt with on its merits.
(*b*) As above.

ASHTON-UNDER-LYNE.

Half wages to all men, married or single, but when such sum, together with Government allowance, exceeds the average weekly earnings, the Corporation allowance is correspondingly reduced. No account has been taken of the extra allowance for children granted short time back, or extra pay earned by promotion.

AYR.

(*a*) The Corporation make up the difference between the Government pay and the wage received prior to joining the colours.
(*b*) Difference made up between army pay and amount paid to dependant.

BARKING.

Full pay, including war bonus, less 7s. per week and separation or dependant's allowance. Commissioned ranks, full pay, less army pay.

BELFAST.

(*a*) Half pay. (*b*) Half pay.

BEXLEY.

(*a*) Half pay. (*b*) Where dependants, half pay.

BIRKENHEAD.

(*a*) Men who joined up to November 15, 1915, full wages, less Government allowance. Since that date, four-fifths wages, less Government allowance.
(*b*) Single men, one-third wages, less Government allowance. Exceptional cases receive special consideration.

BIRMINGHAM.

In each case the amount of their army pay, together with dependants' or separation allowance, has been made up to the amount of wages received from the tramways department.

BLACKBURN.

(*a*) Average weekly earnings made up, less army pay and separation allowance.
(*b*) Each case considered individually and allowances made according to loss of wages sustained by dependants, chiefly amounting to 6s. weekly.

BLACKPOOL.

(*a*) 12s. 6d. for wife, 2s. 6d. for each child under 16 years.
(*b*) Half wages, but in neither case, (*a* or *b*), total pay from all sources to exceed that whilst in municipal service.

BOLTON.

(*a*) Full wages, less army allowances.

BOURNEMOUTH.

(*a*) Difference made up as between army pay and civilian pay.
(*b*) Half pay.

BRADFORD.

(*a*) Full wages, less Government separation allowance and cost of living, estimated at 7s. per week.
(*b*) 10s. per week.

BRIGHTON.

(*a*) Made up to full pay, plus 1s. 6d. uniform allowance, less Government separation allowance.
(*b*) Half pay, plus 9d. uniform allowance. In each case the man's army pay is taken into account, but by the sanction of the L.G.B. the total amount may exceed his normal tramway pay by 25 per cent.

BURNLEY.

Normal wages made up.

BURTON-ON-TRENT.

(*a*) Full wages, less separation allowance and army pay (after deducting allotment).
(*b*) A sum not exceeding 10s., but no more than sufficient to bring army pay up to full wages.

5s. bonus just granted is not added to allowances to men on service, as was done with former bonuses.

BURY.

The difference between the army pay and their wages is made up by the Corporation.

CARDIFF.

Difference between normal weekly wage and army pay, without reckoning recent War Office additional grant to dependants.

CHESTER.

(*a*) Full pay, less all army pay and allowances.
(*b*) Cases individually considered, if they have any dependants.

CHESTERFIELD.

(*a*) Wages made up.
(*b*) Half pay.

COLCHESTER.

(*a*) Difference between separation allowance and wages made up.
(*b*) The dependants of single men are given the same allowances as the wives of the married men.

COLNE.

(*a*) 5s. per week, and an extra 2s. per week for each child.
(*b*) None.

COVENTRY.

(*a*) 10s. per week to wife and 1s. per week extra for each child.
(*b*) Special allowance is made to unmarried employees who have dependants (to whom they have been accustomed to make weekly allowance), averaging 5s. to 6s. per week.

Members of the staff are paid full wages, less the army pay and cost of living, estimated at 7s. per week.

CROYDON.

(*a*) Half average wages.
(*b*) Third of average wages.

DARLINGTON.

(*a*) The difference between their pay and what they receive from the army, less an allowance for the man's food.
(*b*) An amount equal to the amount the man allots to his dependants out of his army pay, with a maximum of 5s. per week.

DARWEN.

(*a*) Government allowance made up to three-quarters their average wage.
(*b*) This is decided by a special committee, the circumstances of his family being taken into consideration.

DERBY.

(*a*) If total pay and separation allowance is less than wages the balance is made up.
(*b*) If total pay and separation allowance is less than wages the balance is made up.

DONCASTER.

(*a*) 50 per cent. ordinary wages, but this sum plus the army allowance has not to exceed the ordinary wages by more than 25 per cent.
(*b*) 33⅓ per cent.

DOVER.

(*a*) Average full wage, less total military income.
(*b*) Three-quarters of average full wages, less total military income.

DUNDEE.

A sum is added weekly to army pay and allowances to bring income up to wages paid in civil employment.

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EAST HAM.

(*a*) Full pay, less amount received from H.M. Forces for separation allowance.

(*b*) Full pay, less amount of pay received from H.M. Forces.

(Any man who obtains promotion to be allowed continuance of the same pay.)

ERITH.

(*a*) The difference between the army allowance and the man's usual earnings.

(*b*) Half the usual weekly earnings.

GLASGOW.

(*a*) Two-thirds wages, less 9s. per week.

(*b*) One-third wages.

GLOUCESTER.

Normal earnings made up by supplementing army or naval pay and allowances.

GREAT YARMOUTH.

Such sums, as with the pay received from the Government, make up their full wages. This applies to married and single men.

HALIFAX.

(*a*) Army pay and separation allowance deducted from normal week's wages.

(*b*) Army pay and dependency allowance deducted from normal week's wages.

HUDDERSFIELD.

(*a*) Full wages, less army or navy allowances and allotment.

(*b*) Full wages, less army pay and allowances.

HULL.

Military allowances, etc., have been made up by the Corporation to the amount which the men would have received had they remained in this service.

Married men the same as single men.

ILFORD.

(*a*) Amount of wages made up—plus a war bonus of 7s. per week.

(*b*) Amount of wages made up.

IPSWICH.

Up to January 23 last 5s. per week for all men up to 25s. per week wages, plus half of any wages beyond that figure.

(*a*) From January 23 last, such an amount, as with army pay and allowances together with an estimated figure of 12s. per week for food, etc., should bring up the total income to not more than civil pay.

(*b*) 2s. 6d. per week, subject since January 23 to the requirement as to the amount of civil pay.

KILMARNOCK.

(*a*) Separation allowance made up to wages at date of enlistment.

(*b*) 7s. 6d. per week.

KIRKCALDY.

(*a*) Make up military pay plus separation allowance to full civil pay.

(*b*) Only with dependants—a sum not more than Government payment to dependants and total received from army pay, separation allowance and tramways department, not to exceed former civil pay.

LANCASTER.

(*a*) Three-eighths of full pay.

(*b*) Three-eighths of full pay.

LEEDS.

(*a*) 5s. per week to wife and 2s. for each child under 15.

(*b*) 5s. per week. Officials half pay.

LEICESTER.

(*a*) Difference between wages paid August, 1914, and amount received from Government.

(*b*) Difference between two-thirds of wages paid in August, 1914, and amount received from Government.

LEITH.

(*a*) Allowance equal in amount to their respective wages, but subject to deduction of any separation allowance.

(*b*) Allowance of 6s. 8d. per week, equivalent to allowance made by Government.

LEYTON.

Full civil pay to all pre-war employees (married or single), less Government emoluments.

LINCOLN.

Wages made up to average normal week, after army pay taken into consideration, plus 6s. war bonus for married men only.

LIVERPOOL.

Difference between army pay and ordinary wages.

LONDON COUNTY COUNCIL.

Full pay, less army pay and separation allowance.

MANCHESTER.

Full pay made up, less army pay, i.e., 7s. per week and separation allowance, but in no case less than half wages paid.

NELSON.

(*a*) Full wages made up, based on 56 hours.

(*b*) No allowance whatever.

NEWCASTLE-ON-TYNE.

(*a*) Ordinary wages, less Government separation allowance, plus 2s. 6d. war bonus.

(*b*) Ordinary wages, less army pay, plus 1s. 6d. war bonus.

NEWPORT.

(*a*) Allowances made so that army or navy pay produces equivalent to amount earned by man when working for department.

(*b*) Sum equal to amount received in army or navy allowed, provided such amount does not exceed present wages. If man has dependants, treated as a married man.

NORTHAMPTON.

The army pay to employees is made up to the wage he was in receipt of when he joined the army. All automatic increases in wages carry on the same as if the man were at work. The war bonus is also given to men on military service, married and single men being treated alike.

NOTTINGHAM.

(*a*) An allowance ranging from 5s. 8d. to 6s. 8d. per week, according to the number of children, and payment of contributions to Friendly Societies.

(*b*) Payment of weekly contributions to Friendly Societies, and in special cases an allowance of 3s. 6d. per week to parents.

OLDHAM.

(*a*) A maximum of 16s. per week to those who were employed before the war.

(*b*) 10s. per week.

PONTYPRIDD.

(*a*) In the case of old employees, the difference between their army pay, allowances, etc., and what they earned whilst in our employ.

(*b*) Ditto.

PORTSMOUTH.

(*a*) Difference between man's tramway pay and his army pay and allowance.

(*b*) Single men joining the forces with the permission of the committee be paid their salaries or wages as at the date of their joining, subject to a deduction being made therefrom of the sum of 15s. per week in each case of lodging, food and clothing, and their respective service pay including one half the Government allowance, if any, for dependants.

PRESTON.

(*a*) The wages of married officers and servants are paid subject to deduction equal to the amount of the Government pay and allowances.

(*b*) Weekly allowance of 5s. made in respect of all unmarried officers and servants.

RAWTENSTALL.

(*a*) Such a sum, as with the pay and allowances, the employee and dependants receive from the Government and elsewhere will amount to the average weekly wage, but in no case shall the total amount received from all sources exceed 32s. 6d. per week. In case of the decease during the present war, the said weekly payment by the Corporation shall cease at the expiration of six calendar months from the date of such decease.

(*b*) One half the average weekly wage, but the maximum weekly payment by the Corporation shall not in respect of any one case exceed 16s. 3d. Employees who are unmarried and without dependants, the said weekly payments by the Corporation shall be set aside for and until the return of such employees, but should any not return, the weekly payments in respect of those shall belong to the Corporation.

READING.

(*a*) The difference between their army pay and allowance and the wages paid prior to enlistment.

(*b*) One-third civil pay, or, when this amount together with army pay and allowances exceeds their civil pay, the difference between army pay and allowance and their civil earnings.

ROCHDALE.

Half wages.

(*a*) Married men receive the difference between army pay and allowances and their previous weekly wages, plus 25 per cent.

(*b*) Half pay.

ROTHERHAM.

(*a*) Ordinary rate of pay, less army pay and separation allowance. Minimum 10s. per week, plus 1s. each child.

(*b*) Ordinary rate of pay, less army pay, 12s. 6d. keep. Minimum, 7s. per week.

SALFORD.

Wages and war bonus, less army pay and separation allowances.

SHEFFIELD.

(*a*) Minimum allowance equal to original scale of Government separation allowance, viz., 1s. 1d. per day for wife and 2d. per day each child. Each case is considered by a sub-committee of the Corporation, and such sum is granted as after taking off a sum (which in no case exceeds 7s.) for the man's board, clothing, etc., when at home, makes the income equal to the normal weekly wages of the man before joining the forces.

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(*b*) No allowance is granted by the Corporation until the soldier makes an allotment to his dependants. Each case is considered on its merits with a view to any deficiency occasioned by the workman having left home being made up either by Government grant or Corporation allowance.

Dependants of employees who are claimed by the military authorities under the Military Service Acts receive no allowance.

SOUTHAMPTON.

(*a*) Half pay in first instance, but men who have joined up since latter part of 1915 received difference between normal pay and Government allowance.

(*b*) Half pay.

SOUTHEND-ON-SEA.

(*a*) Full pay, less army pay and separation allowances.

(*b*) With dependants, three-quarter pay as above; without dependants half pay as above.

SOUTHPORT.

The Corporation make up to full amount of wages all moneys received from the Government—2s. war bonus. This applies to both married and single men.

SOUTH SHIELDS.

(*a*) Difference between military pay (inclusive of all allowances) and weekly wage at date of joining.

(*b*) Ditto.

STALYBRIDGE, HYDE, MOSSLEY AND DUKINFIELD.

(*a*) Average wages made up after taking into account separation allowance and army pay.

(*b*) Not to exceed 5s.

SUNDERLAND.

(*a*) Wages made up.

(*b*) According to circumstances in each case.

SWINDON.

(*a*) Full wages, less army pay and allowances.

(*b*) Ditto.

WALLASEY.

(*a*) Men enlisted from August 3 to November 17, 1914, full pay, less army separation allowance and army pay above the rank of private; since November 17, 1914, one-third pay, providing total income does not exceed wages at time of enlistment.

(*b*) Men enlisted from August 3 to November 17, 1914, full pay, less army pay; since Novermber 17, 1914, one-third pay, providing total income does not exceed wages at time of enlistment.

WALSALL.

(*a*) Half wages to employees who joined prior to November, 1915, provided that such payment, together with Government pay and allowances, does not exceed by more than 10 per cent. the man's civil remuneration, including 3s. war bonus. Employees who have joined since November, 1915, receive an allowance equal to the difference between Government pay and allowances and the wages (excluding bonus) prior to enlistment.

(*b*) Discretionary.

WARRINGTON.

(*a*) Military pay made up to men's wages at present rates, plus war bonus.

(*b*) 10s. per week.

WALTHAMSTOW.

(*a*) Married men are paid a sum which, with their army allowances brings the income of the home to 10s. less than they were earning before enlisting.

(*b*) Each case relating to single men is considered on its own merits.

WEST HAM.

(*a*) Pre-war wages, less army pay and separation allowance.

(*b*) Pre-war wages, less army pay.

WEST HARTLEPOOL.

(*a*) Difference between army and civilian pay.

(*b*) Same as to married men, less 5s. subsistence allowance.

WIGAN.

(*a*) Corporation make up separation allowance to within 5s. of pre-war wage.

(*b*) 5s. per week.

WOLVERHAMPTON.

(*a*) Wife 1s. 1d. per day, plus 2d. per child. Nothing to motor transport men.

(*b*) 7s. 6d. is put aside each week until men return.

YORK.

All men called up or joining the colours up to May 1, 1915, had their military pay and allowance made up to an ordinary average weekly wage, and on going to the front a grant equal to the full week's wage is paid each week. Men joining after May 1, 1915, receive a grant, which, together with their army pay and allowance, brings the total up to an average weekly wage. Full pay to men at the front had to be discontinued as from June 30, 1916, to comply with the requirements of the L.G.B. Special Act.

## WAR BONUS TO EMPLOYEES AND APPROXIMATE COST PER ANNUM TO THE DEPARTMENT.

ABERDARE.

Wages and war bonus, 12s. per week over pre-war wages. Youths under 18, one-half increase.

Cost to department per annum, £1,588.

ABERDEEN.

Male employees, 9s. up to 30s.; 8s. up to 40s.; 7s. 6d. up to 60s.

ACCRINGTON.

Males, 9s. per week, less ½d. per hour increase = 7s. 10d. bonus. Females, 6s. per week, less ½d. per hour increase = 4s. 10d. bonus.

£1,800 bonus. £300 increase.

ASHTON-UNDER-LYNE.

Males, 9s. per week over pre-war rates. Females, 6s. per week over pre-war rates.

£1,700.

AYR.

Male employees, 7s. per week. Female employees, 5s. per week. Under 21 years of age, 3s. per week.

Approximate cost per annum, £1,020.

BARKING.

Men over 21, 4s. increase; 10s. war bonus. Men under 21, 2s. increase; 5s. war bonus.

War bonus only, £687 per annum.

BELFAST.

Motormen, conductors and miscellaneous employees, 9s. per week; tradesmen, from 9s. to 14s. 6d. per week.

Approximate annual cost, £20,500.

BEXLEY U.D.C.

5s. to married men; 2s. 6d. to women, single men and youths.

£1,120. Wages increases in addition approximate amount to £1,800.

BIRKENHEAD.

Staff, 10 per cent.; males, 9s. per week; females, 6s. 6d. per week.

£4,000 per annum.

BIRMINGHAM.

9s. 6d. per week in war bonuses has been granted to employees at an annual cost of approximately £81,510.

In addition, a permanent increase of 2s. per week was granted shortly after the outbreak of war at an annual cost to the department of, approximately, £17,160.

BLACKBURN.

Conductors and motormen, 5s. 7½d. weekly.

£2,193 15s.

BLACKPOOL.

7s. per week to male employees over 21 earning less than 30s. per week; between 30s. and 31s. 6d. wages made up to 37s.; over 31s. 6d. per week, 5s. 6d. Male employees under 21, 4s. 6d. per week. Females, 2s. per week war bonus. (These latter employees have also received ½d. per hour increase.)

BOLTON.

Males over 18, 9s. per week; females over 18, 6s. por week. Males and females under 18, 4s. 6d. per week; all skilled workmen, 15s. per week.

Approximately, £9,000.

BOURNEMOUTH.

Four bonuses granted to weekly-paid staff, bringing total up to 9s. per week each, with 3s. for youths under 18.

BRADFORD.

Females, 6s. per week; males, 12s. per week.

£42,000 per annum.

BRIGHTON.

Married men, 1d. per hour worked, plus 3s. per full week, plus 9d. per week for each child under 16 not earning. Single men, ½d. per hour worked, plus 3s. per full week. Women conductors, ½d. per hour all round, plus 3s. per week to those over 21. Married, plus 9d. per week per child as above. Weekly salaried employees, 6s. per week, plus 1s. 6d. per child.

BURNLEY.

2s. 6d., and 1s. 3d. under 18.

£1,700. Note.—A heavy permanent increase granted from October 25th, 1916.

BURTON-ON-TRENT.

Men, 11s. to 12s. per week, according to rate of pay; women, 7s. 6d. to 7s. 11d. per week, according to rate of pay; youths, 5s. to 6s. per week, according to rate of pay. Women's bonus is based on ratio of hours worked per week (45) to men's hours (60).

Annual cost, £1,560.

BURY.

Male conductors, male cleaners, shed labourers, 9s. per week. Overhaulers, motormen, 7s. 9d. per week. Female conductors and cleaners, 6s. per week.

£4,316.

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CARDIFF.

Traffic employees, ¼d. permanent wages advance, ½d. war wages, and ½d. war bonus. Committee have now offered an inclusive war wage of 1½d. per hour to married and 1¼d. per hour to single men; ½d. per hour to females and ½d. per hour to boys. Other employees, including R.P. station and sheds, 1d. per hour permanent advance and 4s. 6d. war bonus.

CHESTER.

Cashier, 3s. 8d.; clerk, 2s. 4d.; drivers, 4s.; cleaners, 2s.; conductors, 1s.; male inspector, 4s. per week.

£200 per annum.

CHESTERFIELD.

War bonus withdrawn.

COLCHESTER.

Married men, 7s. 6d.; single men, 6s.; women, 2s. 6d. per week.

Approximate, £1,000 per annum.

COLNE.

5s. permanent increase in place of the 6s. 6d. awarded by the Ministry of Production and 2s. 6d. war bonus as the last award by the Ministry of Production.

COVENTRY.

Increases in wages granted since commencement of war as under: March 21, 1915, ¾d. and ¼d. per hour; October 2, 1915, ½d. per hour; July 23, 1916, ½d. per hour; March 4, 1917, ½d. per hour; April 1, 1917, ½d. per hour.

Approximate cost per annum, £6,500.

CROYDON.

Motormen, 5s. per week; male conductors, 5s. per week; women conductors, 2s. 6d. per week; other grades, 7s. per week

DARLINGTON.

Men, 10s. per week; women, 5s. per week.

£1,339.

DARWEN.

No war bonus granted.

DERBY.

Males over 21, 7s. per week advance on pre-war rate and 5s. war bonus. Females, 2s. 3d. war bonus.

Approximate cost, £3,000 per annum.

Previous to May 2, 1917, war bonuses of 3s., 2s., and 1s. 6d. per week to men earning less than 30s., 35s., and 40s., plus ½d. per hour.

DONCASTER.

Increases of from 8s. 6d. to 10s. 6d. per head, as war wages.

Cost per annum, £1,250.

DOVER.

4s. per week to married men and women, and 6d. per child in excess of two under 14 years, and 2s. to all single employees over 18 years.

Approximate cost per annum, £405.

DUNDEE.

1s. per week to those earning between 20s. and 30s. per week.

Total per annum, £352.

EAST HAM.

Tramway employees, 9s. per week over pre-war rates to all men; 1s. 6d. to boys and youths; females, 2s. 6d.

ERITH.

15 per cent. to males, 7½ per cent. to females.

£800 per annum approximate.

GLASGOW.

Semi-skilled and unskilled men, 6s. per week; females, 1s., plus 2s. after six months' service.

GLOUCESTER.

Married or with *bona-fide* dependants, 8s. per week; single males, 4s.; females, 1s. 6d.

Approximate cost per annum, to present employees, £1,532; to dependants, £321; total, £1,853.

GREAT YARMOUTH.

2s. to 4s. per week, according to length of service.

HALIFAX.

4s. per week.

£3,525.

HUDDERSFIELD.

Males, 10s. per week; females, 4s. 6d. Clerical staff: males over 21, 8s.; males under 21, 4s.; females, 4s.

Cost, £9,800.

HULL.

6s. 6d. per week.

£10,000 per year.

ILFORD.

7s. per week, plus 6d. for each child under 14.

IPSWICH.

3s. per week up to 40s. per week wages, 7½ per cent. above and up to £150 per annum, and 5 per cent. on £150 up to £200 per annum.

KILMARNOCK.

7s. to males; 3s. 6d. to females.

£470 per annum.

KIRKCALDY.

2s. March, 1915; 2s. March, 1916; 2s. November, 1916; 2s. April, 1917.

£700 per annum.

LANCASTER.

3s. war bonus to men, 1s. 6d. to boys.

LEEDS.

7s. per week, considered as war wages.

Approximate cost for the year ended March 31, 1917, £10,929.

LEICESTER.

12s. bonus on pre-war rate of pay. Female conductors, 10s.

£25,000 per annum.

LEITH.

£625.

LEYTON.

12s. per week to skilled mechanics over pre-war rate; 1s. 6d. per day inspectors and regulators; 1s. 6d. per day motormen and male conductors; 11d. per day female conductors; 4s. per week ticket department and female clerical staff (temporary); 1s. 6d. per day shed labourers; 11d. per day youths under 21.

£7,350 per annum (approximate).

LINCOLN.

Boys under 16, 5s. 6d. per week; over 16 and under 21, 6s. 6d. per week; able-bodied men of 21 and under 65, 11s. Females under 21, 6s. 6d. per week; 21 and over, 9s.

Approximate annual cost, £793.

LIVERPOOL.

12s. per week males; 7s. 6d. females.

About £56,000 per annum.

LONDON COUNTY COUNCIL.

Amount of war bonus or war wages varies from 3s. 10d. to 15s. per week, according to grade of employee and rate of pay received.

Approximate cost per annum, £225,000.

MANCHESTER.

9s. to all male employees of 18 and over; 4s. 6d. to all males under 18; 6s. per week to women guards; 6s. to women cleaners; 3s. 3d. to trolley girls. Administrative staff—Males receiving from 26s. per week to £150 per annum, bonus 9s.; bonus and salary not to exceed £150. From £150 to £300 per annum, 6s. 6d.; bonus and salary not to exceed £300. Females (all ages), bonus 4s. 6d.

Approximate cost per annum, £73,268.

NELSON, LANCASHIRE.

No war bonus.

NEWCASTLE-ON-TYNE.

Householders and those with dependants, 5s.; single men, 4s.; single men, 18 to 21, 1s. 6d.; single men under 18, 1s. An advance in wages of 5s. has recently been granted to motormen and conductors.

Cost of bonuses per annum, £11,960.

NEWPORT.

Various advances have been made in all departments, as well as 5s. per week war bonus to males over 21.

NORTHAMPTON.

The war bonus at present in force is 4s. per week, plus 1d. per hour for all hours worked for adults, those under 21, 2s. per week, plus 1d. per hour.

NOTTINGHAM.

Ranging from 7s. to 9s. per week.

Approximate cost per annum, £8,721 9s. 8d.

OLDHAM.

Males of 18 and over, 9s. over pre-war rates; males under 18, 4s. 6d. over pre-war rates; females of 18 and over, 6s. over pre-war rates; females under 18, 3s. 3d. over pre-war rates.

Approximate cost, £9,891.

PONTYPRIDD.

Men under 30s., 13s.; men under 40s., 12s.; over 40s., 11s.; boys, 8s. 6d.; youths, 9s. 6d.

£2,600.

PORTSMOUTH.

Up to and including 30s., 3s. a week; above 30s. and up to and including 40s., 2s.; above 40s. and up to and including 45s., 1s. a week. Each married employee receives 6d. a week extra for every child (above one child) under the age of 14. Single employees receive one-half of the above war bonus.

Approximate cost per annum, £2,392.

PRESTON.

9s. per week to all employees with the exception of the officials. Bonus granted to officials as follows:—3s. where wages do not exceed 20s. per week; 6s. where they exceed 20s. but do not exceed 30s.; 4s. 6d. where they exceed 30s. but do not exceed 35s.; 3s. where they exceed 35s. but do not exceed 60s. per week.

RAWTENSTALL.

Permanent advance of 1d. per hour granted to drivers and conductors and 1½d. to cleaners in lieu of war bonus.

Annual cost, about £1,000.

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READING.

War allowances and bonuses. Trade Union awards for the district:—Fitters, 16s.; carpenters, 9s.; painters, 7s.; blacksmiths, 12s.; labourers, 11s.; inspectors, 5s. permanent increase; motormen and conductors, maximum 8s.

ROCHDALE.

9s. per week to males over 18; 6s. to females over 18.

ROTHERHAM.

11s. per week motormen and conductors (male); 9s. conductors over 21; 5s. a week conductors under 21.

SALFORD.

Tradesmen's war wages, 15s. per week, included in rate of pay. Employees' war bonus (other than tradesmen):—Males, 18 years and over, 9s. per week; under 18, 4s. 6d. Females, 18 and over, 6s.; under 18, 3s. 3d.

£33,500.

SHEFFIELD.

15s. per week to engineers, handymen, overhaul fitters, wiremen, and coachmakers; 12s. to drivers and shed labourers; 12s. to conductors (men); 7s. to conductors (women); 13s. to car cleaners (men); 7s. to car cleaners (women).

£51,337.

SOUTHAMPTON.

9s. a week to men receiving 27s.; 8s. 6d. to men receiving 27s. 6d.; 8s. to men receiving 30s. to 40s.; 6s. to men receiving 40s. to 50s.; 4s. to men receiving 50s. to 60s. Female conductors and car cleaners, 4s.

£5,099 per annum.

SOUTHEND-ON-SEA.

5s. for married men; 3s. for single men.

£1,053 10s. per annum.

SOUTHPORT.

All men over 18 have received 8s. on pre-war wages, 4s. 5d. of which is war bonus and 3s. 7d. permanent increase in rate of pay. All women, 3s. 6d. per week war bonus.

Approximate cost, £850 per annum.

SOUTH SHIELDS.

11s. per week to married men; 6s. 6d. per week to single men; 2s. per week to boys.

£2,000 annually.

STALYBRIDGE, HYDE, MOSSLEY, AND DUKINFIELD.

Males over 18, 9s. per week; under 18, 4s. 6d. Females over 18, 6s.; under 18, 3s. 3d.

£5,000.

SUNDERLAND.

11s. men; 6s. women; 3s. 6d. youths (under 18).

£6,344.

SWINDON.

4s. per week to married men up to 45s.; 3s. to married men up to 30s. All the employees have received increases in wages of varied amounts, and there is an application under consideration for the war bonus to be increased to 10s. per week.

WALLASEY.

Males over 18, 6s. 6d. per week; males under 18, 3s. 3d. Females, 2s. 6d.

£2,660 per annum.

WALSALL.

Present war wages:—Males over 21, 9s. per standard week; 18 to 21, 7s. 6d. per standard week; under 18, 4s. per standard week; females over 21, 7s. per standard week; 18 to 21, 5s. per standard week.

Approximate cost per annum, £4,100.

WARRINGTON.

9s. per week to men over 18; 4s. 6d. to men under 18; 6s. per week to women.

£2,219.

WALTHAMSTOW.

8s. 6d. per week to employees supporting a home and 5s. per week to remainder.

£1,200.

WEST HAM.

Skilled and semi-skilled, in accordance with engineering award. All other male employees increase on pre-war rate aggregating 9s. per week of six days. Females over 21, 4s. 6d. per week; under 21, 3s. 6d.

Approximate cost, £17,500.

WEST HARTLEPOOL.

9s. per week, plus 6d. for each child under 14.

£1,600 per annum.

WIGAN.

Officials, 15 to 30 per cent.; motormen, conductors (male), and labourers, 9s.; female employees, 6s.; youths and girls under 18, 4s. 6d.; skilled men, fitters, etc., 15s.; coach painters and bodymakers, 12s.

Approximate cost per annum, £4,979.

WOLVERHAMPTON.

2s. war bonus granted March 1, 1915; 3s. May 1, 1916; 5s. granted April 1, 1917.

Approximate cost per annum, £5,200.

YORK.

| | Householders. | Single. | Under 18. |
|---|---|---|---|
| 30s. and under | 9s. | 5s. | 2s. 6d. |
| 31s. to 43s | 8s. | 4s. | |
| 44s. | 7s. | 3s. | |
| 45s. to 57s. | 6s. | 2s. | |
| 58s. | 5s. | 2s. | |
| 59s. | 4s. | 2s. | |
| 60s. | 3s. | 2s. | |
| 61s. | 3s. | 1s. | |
| 62s. to 96s 8d. | 3s. | | |
| 97s. 8d. | 2s | | |
| 98s. 8d. | 1s. | | |
| 99s. 8d. and over | — | | |

**SUMMARY.**

| | July, 1916 | July, 1917 |
|---|---|---|
| Number of municipal authorities replying to queries | 88 | 84 |
| Number of towns certified under Munitions of War (Amendment) Act | 44 | 57 |
| Number of employees at normal times | 55,208 | 55,208 |
| Number of men who have joined His Majesty's Forces | 20,905 | 29,268 |
| Percentage to total | 38 | 53 |
| *Number of men who have left municipal tramways undertakings to join munition factories | 1,893 | 1,776 |
| Percentage to total | 3½ | 3·2 |
| Amount paid to dependants of employees serving with His Majesty's Forces | £854,649 | £1,437,603 |
| Average allowance per man per week | 10s. 7½d. | 11s. 4½d. |
| Amount collected on cars for various national and other objects | £43,800 | £84,509 |
| Amount contributed by municipal tramway employees to various relief funds | £36,070 | £38,170 |
| Number of municipal systems employing women conductors | 75 | 76 |
| Number of women conductors | 8,433 | 11,757 |
| Number of municipal systems employing women drivers | 7 | 18 |
| Number of women drivers | 176 | 611 |
| Number of municipal systems employing auxiliary drivers | 19 | 26 |
| Number of auxiliary drivers (male) | 320 | 564 |

* The figures under this heading are only approximate, as it is not known what particular section or unit the men have joined, and therefore in some cases these have been included in enlistments.

## EDINBURGH TO QUEENSFERRY TRAMWAY.

The Edinburgh Town Council on October 30 decided to apply for Parliamentary powers to construct an electric tramway from Edinburgh to Queensferry—a distance of eight miles. The Council had before it as a basis reports by Mr. J. B. Hamilton, general manager of Leeds City Tramways, Mr. Peter Fisher, general manager of Dundee Corporation Tramways, and Mr. A. H. Campbell, burgh engineer of Edinburgh.

Messrs. Hamilton and Fisher, in their reports, expressed the view that the estimates for construction prepared by the burgh engineer are more than ample to cover all costs of construction which it is reasonable to forecast. After having gone into figures of population, of pleasure traffic, and estimates of revenue and working expenses, they believe that the Tramways Committee need have no hesitation in recommending the construction of the line. With a capital expenditure of £185,000, they estimated a net annual surplus of £5,000. The burgh engineer had put the figure at £2,792.

Mr. Campbell, in his report, which was supplementary to one previously issued, discussed the relative costs of motor omnibuses and electric tramways. He stated that the cost of working motor omnibuses may be estimated at from 8·5d. (pre war) to 13·17d. and upwards to 16·81d. per mile run of 32 passengers (current maximum rate). The cost of working an electric tramcar may be stated at from 5·9d. to 11·44d. (current maximum rate) per car-mile of 62 passengers. The total cost of tramway operation on the Queensferry route he put at 11d. per car-mile, as against 11·753d. per omnibus-mile. Per passenger the respective costs are ·183d. for the tramcar, and ·346d. for the omnibus. The motor omnibus is in the total of operating and capital costs approximately 89 per cent. more expensive than the tramcar, seat for seat.

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| MUNICIPAL TRAMWAYS. | Number of Employees at Normal Times. | Number of Employees with the Colours. | Number Joined Munition Factories, etc. | Average Allowance per Man per Week. | Amount Paid to Dependants to July 31, 1917. | Total Amount Collected on Cars. | Amount Contributed by Employees. | Number of Women Conductors. | Number of Women Drivers. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | s. d. | £ | £ | £ | | |
| Aberdare | 65 | 54 | — | 11 0 | 1,521 | — | 220 | 6 | — |
| Aberdeen | 325 | 177 | — | 11 6 | 7,500 | 65 | — | 118 | 5 |
| Accrington | 125 | 66 | 5 | 10 4 | 2,454 | 38 | 71 | 31 | 3 |
| Ashton-under-Lyne | 75 | 54 | — | 14 2 | 2,929 | 38 | 34 | 23 | — |
| Ayr | 100 | 59 | 2 | 8 0 | 346 | — | — | 21 | 19 |
| Barking | 28 | 16 | 2 | 16 6 | 284 | — | — | — | — |
| Belfast | 1,080 | 285 | 1 | 15 5 | 22,520 | — | 1,500 | — | — |
| Bexley U.D.C. | 60 | 27 | 48 | 15 6 | 980 | — | — | 30 | — |
| Birkenhead | 228 | 90 | 1 | 10 6 | 4,235 | 4,200 | 200 | 76 | — |
| Birmingham | 3,300 | 1,713 | — | 10 6 | 104,029 | 300 | 2,268 | 990 | — |
| Blackburn | 350 | 210 | 15 | 10 9 | 6,562 | — | 155 | 51 | 25 |
| Blackpool | 240 | 91 | — | 13 3 | 4,967 | — | 200 | 75 | 10 |
| Bolton | 470 | 195 | 242 | 10 8 | 6,596 | 308 | — | 75 | — |
| Bournemouth | 400 | 240 | 20 | 11 6 | 12,313 | 12 | 311 | — | — |
| Bradford | 1,370 | 640 | 86 | 14 0 | 31,832 | — | 5,504 | 365 | — |
| Brighton | 300 | 235 | 2 | 11 1½ | 10,012 | — | — | 96 | — |
| Burnley | 439 | 373 | 5 | 8 3 | 11,053 | — | — | 61 | — |
| Burton-on-Trent | 87 | 40 | 5 | 10 9 | 1,858 | 8 | — | 18 | — |
| Bury | 260 | 122 | — | 13 2 | 5,369 | — | — | 80 | — |
| Cardiff | 730 | 350 | — | 8 0 | 13,890 | — | — | 160 | 25 |
| Chester | 52 | 15 | 24 | 6 1 | 429 | — | — | 15 | — |
| Chesterfield | 90 | 46 | 2 | 5 4 | 2,141 | — | 150 | 23 | 12 |
| Colchester | 66 | 64 | 3 | 6 1 | 586 | — | — | 23 | — |
| Colne | 50 | 18 | 4 | 10 6 | 247 | — | — | 5 | — |
| Coventry | 314 | 114 | — | 12 5 | 2,037 | — | 307 | 67 | 5 |
| Croydon | 385 | 201 | 5 | 14 6 | 14,657 | — | — | 107 | — |
| Darlington | 57 | 38 | 9 | 7 11 | 689 | — | 52 | 22 | 12 |
| Darwen | 68 | 30 | — | 11 2 | 1,380 | — | — | 11 | — |
| Derby | 256 | 128 | — | 11 2 | 4,036 | — | 107 | 64 | — |
| Doncaster | 90 | 79 | 6 | 9 1 | 3,079 | 45 | 90 | 48 | 21 |
| Dover | 60 | 31 | — | 7 7 | 1,214 | — | — | 18 | — |
| Dundee | 274 | 162 | 6 | — | 2,013 | — | 142 | 89 | — |
| East Ham | 268 | 135 | — | 17 4 | 9,290 | — | — | 44 | — |
| Erith U.D.C. | 45 | 9 | 26 | 9 2 | 23 | — | — | 17 | — |
| Glasgow | 6,135 | 3,230 | 328 | 17 3 | 196,062 | 32,469 | 6,082 | 1,328 | 393 |
| Gloucester | 125 | 62 | 2 | 11 4 | 2,907 | — | 74 | 26 | — |
| Great Yarmouth | 144 | 85 | 3 | 9 7 | 766 | 650 | — | — | 5 |
| Halifax | 423 | 254 | 18 | 20 3 | 13,047 | 109 | — | 107 | — |
| Huddersfield | 460 | 194 | 5 | 8 3 | 11,879 | 184 | 474 | 94 | — |
| Hull | 650 | 350 | 20 | 13 0 | 22,700 | — | — | 170 | — |
| Ilford | 136 | 53 | — | — | 2,424 | — | — | 29 | — |
| Ipswich | 188 | 66 | 21 | 5 0 | 1,723 | — | — | 38 | — |
| Kilmarnock | 50 | 25 | 4 | 7 6 | 369 | 25 | — | 17 | 7 |
| Kirkcaldy | 65 | 55 | — | 13 4 | 370 | — | — | 25 | — |
| Lancaster | 35 | 13 | 5 | 9 9 | 619 | — | — | — | — |
| Leeds | 1,950 | 1,009 | 125 | 5 6 | 34,200 | 1,312 | 1,739 | 450 | — |
| Leicester | 1,005 | 634 | 4 | 8 2 | 28,415 | 120 | 545 | 221 | — |
| Leith | 130 | 78 | 5 | 14 0 | 1,392 | 490 | 60 | 50 | 22 |
| Leyton | 350 | 203 | 10 | 16 6 | 11,767 | — | — | 86 | — |
| Lincoln | 31 | 10 | 2 | 11 7 | 115 | 10 | 4 | 6 | — |
| Liverpool | 2,800 | 1,950 | 300 | 12 0 | 86,000 | — | 2,000 | 900 | — |
| London County Council | 12,612 | 3,201 | 198 | 19 2 | 288,545 | 387 | 7,380 | 1,532 | — |
| Manchester | 5,000 | 2,735 | — | 15 11 | 179,500 | 26,725 | 4,033 | 810 | — |
| Nelson | 41 | 25 | — | 7 1 | 653 | — | — | 6 | — |
| Newcastle-on-Tyne | 1,160 | 582 | 146 | 14 5 | 30,283 | 411 | 1,457 | 360 | — |
| Newport | 220 | 98 | — | — | 2,255 | 112 | 100 | 59 | 29 |
| Northampton | 147 | 80 | 3 | 17 0 | 3,392 | — | 31 | 37 | — |
| Nottingham | 622 | 313 | 127 | 6 0 | 6,893 | 3,377 | 350 | 184 | — |
| Oldham | 481 | 341 | — | 12 2 | 14,906 | 316 | 335 | 93 | — |
| Pontypridd | 96 | 80 | — | 9 0 | 1,411 | — | 33 | 25 | — |
| Portsmouth | 555 | 301 | 30 | — | 9,405 | — | — | 160 | — |
| Preston | 250 | 126 | 15 | 7 6 | 3,509 | 50 | 153 | 62 | — |
| Rawtenstall | 110 | 44 | 4 | 11 0 | 1,022 | 9 | 30 | 21 | — |
| Reading | 180 | 161 | 3 | 7 11 | 3,537 | — | 53 | 52 | — |
| Rochdale | 288 | 152 | 7 | 16 0 | 8,454 | 89 | — | 60 | — |
| Rotherham | 160 | 75 | 24 | 10 4 | 2,629 | — | — | 75 | — |
| Salford | 1,280 | 641 | 12 | 19 7 | 42,863 | 2,149 | 2,351 | 289 | — |
| Sheffield | 1,708 | 535 | — | 12 6 | 33,508 | 10,194 | 463 | 637 | — |
| Southampton | 350 | 183 | 6 | 11 11 | 11,476 | — | — | 100 | — |
| Southend-on-Sea | 180 | 115 | 20 | 8 9 | 4,859 | — | 120 | 50 | 5 |
| Southport | 92 | 60 | 2 | 10 0 | 2,321 | 55 | — | 30 | — |
| South Shields | 140 | 90 | 5 | 11 10 | 5,240 | — | — | — | — |
| Stalybridge | 230 | 140 | 12 | 5 2 | 2,770 | — | 300 | 52 | — |
| Sunderland | 295 | 153 | 21 | 8 0 | 3,172 | — | — | 85 | — |
| Swindon | 45 | 22 | — | 13 8 | 1,662 | — | — | 11 | — |
| Wallasey | 238 | 146 | 1 | 11 0 | 6,993 | 39 | 254 | 78 | — |
| Walsall | 145 | 89 | 28 | 11 5 | 2,499 | — | 123 | 44 | — |
| Warrington | 84 | 40 | 2 | 14 7 | 1,733 | — | 137 | 31 | — |
| Walthamstow | 200 | 76 | 42 | — | 3,200 | — | — | 80 | — |
| West Ham | 781 | 465 | — | 12 2 | 41,395 | — | — | 168 | — |
| West Hartlepool | 107 | 60 | — | 9 4 | 804 | — | — | 33 | 7 |
| Wigan | 300 | 100 | 1 | 10 3 | 1,935 | — | 171 | 64 | — |
| Wolverhampton | 217 | 106 | — | — | 2,889 | 134 | 156 | 58 | — |
| York | 130 | 87 | 2 | 11 0 | 4,061 | — | — | 53 | 6 |

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# ACCIDENT ON DOVER CORPORATION TRAMWAYS.

COLONEL J. W. PRINGLE'S REPORT TO THE BOARD OF TRADE.

The Board of Trade published on October 29 the report of Colonel J. W. Pringle on the serious accident which occurred on August 19, when a car, getting out of control in descending Crabble Hill, overturned. The report is dated September 13, and the full text is appended :—

I have the honour to report for the information of the Board of Trade, in compliance with the instructions contained in your minute of August 20, 1917, the result of my inquiry into the circumstances attending the very serious accident which occurred on the Dover and River Light Railway at about 3.25 p.m. on August 19.

In this case Car No. 20 got out of control as it was descending Crabble Hill. The speed rapidly increased, and the car left the rails on a curve at the foot of the hill. In crossing the road to the right it overturned, and, in falling, struck the front wall of Crabble Paper Mills premises. I regret to report that the conductress and 10 passengers were either killed or died subsequently from injury ; and that all the remaining passengers (59) suffered more or less seriously from injury or shock. The driver, A. J. Bissenden, jumped from the platform half way down the hill, and escaped unhurt.

The gauge of the Dover Corporation Tramways, of which this route is a section, is 3 ft. 6 in. Car No. 20 was a double-deck, single-truck car. It contained seating accommodation for 22 inside and 26 outside passengers. The principal dimensions were as follows :—

| | | | |
|---|---|---|---|
| Length over all ... | 27 ft. 1 in. | Width over all ... | 6 ft. |
| Length over body | 16 ft. 3 in. | Wheel-base ... ... | 6 ft. |

It was equipped with :—

(*a*) Hand brake working cast-iron blocks on all four wheels by means of a handle, vertical spindle, and chain.

(*b*) Electric rheostat brake.

(*c*) Track brake, consisting of two oak-shod shoes, one between each pair of wheels, actuated by hand wheel from each platform.

The section of tramway concerned (Dover and River Light Railway No. 1) commences in London Road at the old Buckland terminus, and has a total length of 4 furlongs 2 chains. Double track is laid throughout. The first three furlongs are in London Road, and the remainder in Crabble Hill Road. In the northward direction the gradients along London Road rise continuously to the junction with Crabble Hill Road. The inclination near the summit is about 1 in 21·5 for a length of 200 yards. From the summit (X) the gradients fall as follows :—

| | | | |
|---|---|---|---|
| 200 ft. ... | Average 1 in 24·5 | 180 ft. ... | Average 1 in 12·8 |
| 90 ft. ... | ,, 1 in 10·4 | 120 ft. ... | ,, 1 in 33·0 |
| 100 ft. ... | ,, 1 in 11·5 | | |

There is a left-hand curve (radius 90 ft.) about 215 ft. from the point X, and a second left-hand curve (radius 180 ft.) about 560 ft. from X. The super-elevation on these two curves is 1·03 and 0·9 in. respectively. Crabble Hill Road is crossed by an arch carrying the South Eastern and Chatham Railway at a point 415 ft. from X.

The route was inspected in September, 1905, and opened to traffic shortly afterwards. There has been no previous case of a car getting out of control.

The Board of Trade regulations for traffic are as follows :—

(1) Speed is limited (*a*) to 12 miles an hour in London Road between Old Park Road and the junction with Crabble Hill ; (*b*) to four miles an hour from Crabble Hill Road at its junction with London Road to the Crabble Paper Mills.

(2) The track brake has to be applied to all cars before leaving the junction of Crabble Road and London Road on the downward or northward journey.

(3) All cars have to be brought to a standstill before reaching the junction of London Road and Crabble Road on the northward journey.

Driver A. J. Bissenden was formerly in the army (Army Ordnance Department). He returned to England in February, 1917, after 15 months' service in Egypt, suffering from nervous breakdown due to heat and overwork. He was discharged from the army as unfit for further military service on June 1, 1917. He applied for employment on the Dover tramways on July 21, 1917. The manager (Mr. Carden) judged he was likely to prove suitable for the position of motorman, and put him for instruction under Driver Brett, who had over ten years' service on the Dover Tramways. He was under tuition for nine days. During this time he was kept under observation, and after examination by Electrician Bond he was finally put on the list as regular motorman on August 1. Between August 1 and August 15 inclusive he drove a car daily on the level portion of the tramway system between Buckland and the Pier. On August 16 he drove a service car for the first time on the River section. Prior to the accident he had driven down Crabble Hill on service on eight or ten occasions.

On August 19 he came on duty at 10 40 a.m., and drove on the Buckland-Pier route until 1.38 p.m. After dinner he relieved, at 2.40 p.m., another driver on Car No. 20 to work the River route service. He proceeded first to the Pier, and there turned to run to the River terminus at Minnis Lane. Before reaching Buckland the conductress (Lottie Scrase) told him that the car was full, so as to avoid stopping at traffic points to pick up other passengers. Bissenden stopped the car at the foot of the hill near the Buckland tramway shed by using the hand brake, which was then working efficiently. He then proceeded up the incline in London Road, and, passing the summit, threw over his controller, and tried to stop the car at the compulsory stopping-place with the hand brake. The actual spot where the cars are accustomed to stop is about 100 ft. below the actual summit. He found the brake would not stop the car—the brake handle turning round as if something was wrong with the spindle and chain. He then tried to screw down the slipper brake, but the car was making speed so rapidly that the blocks would not hold. He then tried to apply the rheostatic brake, but could not get the small reversing handle to move into the right position. As he could do nothing more, he jumped off the front platform before the car reached the railway arch.

Other witnesses relate that a soldier (Trooper Gunner) and a gentleman (Naval Pensioner Miller) went on the front platform after the driver had jumped off it. It is not clear whether these men attempted to work the brakes or not. The impression given by the evidence of other passengers inside the car is that they appeared to be using their right hands. In any case, no retardation of speed was effected. A passenger on the top deck states that the jolt, when the car passed over the first curve, was so severe that a number of passengers who were standing on the top deck were nearly thrown off it. Passing under the railway arch the trolley pole left the conductor wire and swung loose. The conductress was on the top deck during the rush of the car down hill, and no one was observed to attempt to apply the hand or slipper brake from the rear platform.

About 140 feet below the railway arch, with speed further accelerated by the decline, the car entered the second curve and left the rails. There are clear marks on the setts of two wheels leaving the right-hand rail, but no corresponding marks of the left-hand wheels. The wheel-marks cross the road diagonally to the right for a distance of about 39 ft., and then disappear. It is evident that on this short distance the car was overturning to the right, with the left-hand wheels in the air. In falling over, first the trolley pole or standard came into contact with the wall of the Crabble. Paper Mill, and then the front portion of the top railing of the upper deck. The blow broke down the wall and, as the side of the car came down to road level, the momentum carried the car forward on its side, whilst the rear end swung round to the left, so that finally, when the car came to rest, it lay on its right side at right angles to and across the roadway.

I examined the condition of the car after it had been moved to one side of the roadway. The two oak shoes of the track brake showed considerable signs of wear, but they were still in thoroughly serviceable condition. They were out of adjustment as the result of the accident, but could still be operated by the hand-wheel at each end of the car. The cast-iron wheel blocks were also adequate for service purposes. Those at the rear were tight on the wheels, with the chain taut. On the front wheels the blocks and chain were loose. It was still possible to work the hand lever operating the wheel blocks on both platforms. The controller contacts and fingers were in fair order, and there was no difficulty in moving either the controller or power handles in any of the proper directions. Generally speaking, all the brake equipment was in adequate working order, allowing for damage caused by the accident. There was also a supply of sand in the four boxes, and no evidence of choking in the sand pipes. The track is in good condition for speeds considerably in excess of that authorised.

Bissenden states that after the accident he found the front brake chain, which is wound round the spindle to bring the blocks to bear on the wheels, unhooked from the rod operating the levers. He claims that this disconnection was the cause of the failure of the hand brake to stop the car at the Board of Trade stopping-place. On the other hand, the brake was in working order, by his own account, when he stopped the car at Buckland tramway shed. Moreover, he denies that it was his practice to allow any more slack on the brake chain than was sufficient to ease the blocks off the wheels. I do not therefore think it was possible for the chain to become unhooked whilst the car was travelling a distance of about 700 yards from the tramway shed to the top of Crabble Hill. Possibly, after Bissenden jumped off the car, either Trooper Gunner or Mr. Miller, if they worked the hand brake handle, turned it in the wrong direction, and thereby caused the chain to slacken considerably off the spindle and hang loose. If this was done it is arguable that the dog was not in the ratchet, and the hand brake not applied when Bissenden jumped off the car. In the evidence at the coroner's inquest, Driver Pay, whose attention after the accident was called by Bissenden to the condition of the front brake, states that the chain was slack and loose, but not unhooked.

The evidence given by Driver Cook and Mechanic Knott, who were the first to observe the position of and remove the controller handles, is to the effect that the small handle was in the "ahead."

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and the large in the "last power" (full parallel) position. I agree with these witnesses that no jolting or jarring during the overturning of the car is likely to have thrown both the handles into these positions, and they bear no marks of having been struck by any object.

Bissenden's own statement that he was unable to move the controller (small) handle into the emergency brake position confirms, in my opinion, the view that power was applied as the car came down the hill. The interlocking of the two handles makes it impossible to move the small handle unless the large (power) handle is in the "off" position. I proved for myself after the accident that there was no difficulty in moving the controller handle from "ahead" to "astern" or "emergency" with the power handle in the "off" position.

I come therefore to the conclusion that this lamentable accident was caused by Driver Bissenden failing to cut off power as he approached the compulsory stopping-place on the summit of Crabble Hill, and by his further failure to utilise properly the sand and brake equipment. Power was not, I think, cut off until the trolley left the conductor at the railway bridge, when the speed attained by the car probably already exceeded 20 miles an hour. It is evident that Bissenden completely lost his head at the critical moment.

I have to draw attention to three important points in connection with this accident:—

(1) Nerve and experience are necessary qualifications for tramway drivers, especially when traffic has to be conducted over severe gradients and in crowded centres. Men discharged as unfit for military duties on account of nervous breakdown are unlikely to prove suitable, two months later, as drivers on difficult routes. At all events, medical opinion should be sought before a candidate of this description is accepted. I doubt whether Local or County Appeal Tribunals are aware of the difficulties which tramway managers nowadays encounter in finding suitable substitutes to fill the places of experienced drivers taken for military service, or attracted by higher-paid employment. Possibly also they do not recognise the risk that is incurred by the public when insufficiently trained men are employed.

At my request the manager of the Dover Corporation Tramways has furnished me with information regarding the length of service, etc., of tramway drivers on the system. At the outbreak of war 24 men were employed. Of these, 16 had five or more years' service, and only four had less than one year's service. None of them were under 23 years of age. At the present moment the staff has been reduced to 18. Of these, five only have five or more years' service, nine have less than two months, two less than four months, one less than eight months, and one under 15 months' service. Six of those now employed are under 18 years of age. During the war 22 drivers have enlisted, or been claimed for military service, and 19 have left for better-paid employment. These figures speak for themselves. I do not think that the accident would have occurred had it been possible to maintain a staff of experienced drivers, such as was in existence in August, 1914. The fact must be faced that the war has materially reduced safe working conditions on tramways. It is better policy to close a route of this description, if the number of experienced drivers is insufficient to work it, than to employ men who have not, as a general rule, a year's experience to their credit.

(2) A longer training (especially with regard to the use of the rheostatic brake) and experience than that possessed by Driver Bissenden are necessary to qualify a driver to work traffic on such a section as the River route. It is evident that Bissenden's lack of familiarity with the rheostatic brake was a contributory cause of this accident. He had only used it once previously on service.

(3) Overcrowding, when a car gets out of control on a steep gradient, causes a serious list of casualties. If that can be avoided the list in an accident of this sort is likely to be comparatively small. The liability to overturn on the narrow (3 ft. 6 in.) gauge is considerably greater than on the ordinary (4 ft. 8½ in.) gauge. The determining factors in overturning, outside the gauge, actual speed, curvature, super-elevation, etc., are the height of the centre of gravity of the car and the nature of the load—i.e., fixed or shifting. The more passengers on the top deck the higher becomes the centre of the gravity. Standing passengers add to the shifting character of a load of human beings, and increase the instability.

From the casualty list there appear to have been 68 passengers in the car—20 more than the seating accommodation. How many were on the upper deck is uncertain; but there must have been, from passengers' accounts, 30 or more. It was, I think, this heavy load on the upper deck, which had already been jolted violently out of position when the car passed round the first curve, which eventually caused it to overturn when it left the rails at the lower curve with a further violent jolt in the same direction.

My recommendations in the case are:—

(a) That only motor drivers of considerable experience (say twelve months) be permitted to work the traffic on Crabble Hill.

(b) That the men be familiarised with the rheostatic brake by being instructed to use it more frequently.

(c) That either single-deck cars be used for traffic on Crabble Hill, or no passengers be permitted to travel on the Hill on the upper deck.

## DICK, KERR & COMPANY, LIMITED.

### Notable Expansions and Increased Profits.

The ordinary general meeting of the shareholders of Dick, Kerr and Company, Limited, was held on October 31st at Cannon Street Hotel, E.C. Mr. Claud T. Cayley, chairman of the company, presided, supported by Messrs. R. H. Prestwich (deputy chairman), D. C. Ellis, J. Sampson, T. D. Lingard, and W. Rutherford (managing director).

The report and statement of accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, pointed out that the net profit showed an appreciable increase. The totals of assets and liabilities indicated the magnitude of the company's operations, though under present circumstances the directors were unable to publish details. The assets were £2,193,688, compared with £1,753,410 last year, the increase being chiefly made up by the difference in the item sundry investments, also increases in the items of stock in hand and work in progress, contract balances, and sundry debtors. The latter items were always liable to fluctuation from year to year, and did not call for comment. With regard to the increase in the figure of investments, this was the result of the acquisition of the shares in the United Electric Car Company, Limited. The capital expenditure at the works showed a decrease, due to the policy of writing off what was considered ample depreciation against this item, a policy which they were sure had full approval, all the more so since nobody could forecast what post-war conditions would be in the business world, and it therefore seemed essential to avoid the least possibility of inflation of the capital assets. The liabilities side of the sheet showed one particularly important variation from last year's figures, namely, the increase under the heading of creditors and estimated liabilities. This figure was £953,596, which was a large advance upon last year, although the increase was set off by the increases on the asset side of the balance sheet. The reason for this increase in the figure of creditors was that it included the reserve set aside for the excess profits duty, as although the liability under that heading had not yet been definitely settled, it was very necessary to reserve what was considered a sufficient sum to meet this charge.

### Government Orders.—United Electric Car Company

The Government continued to be their principal customer, with continuously increasing demands both in quantity and variety He wished he were allowed to tell them in detail of the ramifications of manufacture and construction which had been undertaken and successfully completed by their organisation; and still more would he have liked to tell them of what was being done now and about to be done in the immediate future. Suffice it to say that all the departments for which they were working, both at the Admiralty and the Ministry of Munitions, showed their appreciation and confidence in a very practical way, by entrusting them with important work to the limit of the company's capabilities. As mentioned in the report, the national factory erected under the company's auspices had been handed over to the Government, and they had now in hand the erection of two more factories for another purpose. These, together with the construction of important works in different parts of the country, on which it had been occupied for some time, kept the contracting department very busy, and the staff of trained engineers fully occupied. As to the controlling interest which had been acquired on the United Electric Car Company, Limited, he was glad to say that the board already felt this transaction to be fully justified, so much so that steps had been taken to extend the shops to cope with work of great importance entrusted to them by the Government. The United Electric Car Company were next-door neighbours at Preston, the works occupying an area of 15 acres, and they made a speciality of tramway car building. The directors were satisfied that after the war there would be no difficulty in keeping them fully occupied upon profitable work, and in the meantime, as already indicated, they were serving the national interests.

Last year they reported the acquisition of control in Willans and Robinson, Limited. The position had now been consolidated by the acquiring of 86 per cent. of the preferred "B" stock of that company, which had certain participating rights. This transaction was carried through partly by payment in cash and partly by exchange of shares. As it did not take place until after the close of the year under review it was not reflected in the balance sheet. Steps were now being taken to consolidate the organisations of the two companies, and considerable economy was to be expected both in selling and production. Considerable interest had been shown in the contracting world and among the legal profession in the now somewhat celebrated case of the Metropolitan Water Board *v.* Dick, Kerr and Company. This was still *sub-judice*, as although it was argued the previous week in the House of Lords, judgment had not yet been given. He had given them the position as the directors saw it at present, and it might be taken for granted their organisation and works would be fully occupied during the continuance of the war.

### Organising for the Future.

Last year, and the year before, he indicated the likelihood of having to face a period of uncertainty during the transition from



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war conditions to normal conditions of peace, whatever the world had in store for us in that direction. The directors and management committee fully realised this, and therefore, in spite of the abnormal amount of work thrown upon their shoulders, particularly the latter gentlemen, they were doing what they could towards organising for the future, so as to make this transition period as short as possible. They might safely assume the immediate demand for the product of their different manufacturing works, and also of the engineering contracting organisation, would be very great, and it behoved the management to see they were in a position to step into the breach without delay. Like all large employers, they were naturally following the attitude of labour itself, and fully realised that to meet the necessities of after-the-war conditions a complete understanding and co-operation between capital and labour was both desirable and necessary. The directors and management committee had confidence that all would be well in this direction, provided labour was met in a spirit recognising that an entirely new basis of relationship must be established. If the country and the empire met the new conditions that were bound to arise after the war fairly and squarely by adopting new methods of empire and international commercial relationship, he thought the internal relationship of employer and employed could safely be left to the commonsense of those directly concerned. In concluding, the chairman said that the particulars were given very fully in the report, and that further comment was unnecessary. In the liabilities was included the sum set aside to meet excess profits tax. The assets included £762,000 for stock and materials, which, though apparently large, was not large when they considered the extent of the business operations. He moved that a dividend of 10 per cent. be paid on ordinary shares and the payment on preference shares be confirmed.

Mr. R. H. PRESTWICH seconded, and the motion was carried unanimously.

Mr. PRESTWICH moved the re-election as directors of Mr. C. D. Ellis and Mr. Cayley, the chairman. He could not speak too highly of the services rendered by those gentlemen, the latter's services during the last two years having been exceptionally valuable. The special knowledge he possessed had been of the greatest assistance to the management committee.

Mr. T. D. LINGARD seconded, and the motion was agreed to unanimously.

The CHAIRMAN thanked the shareholders for his re-election and assured them that his services would always be at the service of the company. He had done his best, but they would all see that the position of the company was now entirely different from what it was two and a half years ago. He paid a high tribute to Mr. Rutherford who, he said, had been a wonderfully apt pupil, who really knew more about it than he did himself.

Mr. ELLIS also briefly acknowledged his re-election.

Messrs. Gane, Jackson, Jefferys and Freeman were re-elected auditors.

APPROVAL OF THE BOARD'S POLICY.

Mr. E. J. FOX, in proposing a vote of thanks to the chairman and directors, said he wished to congratulate the board on the policy which they had adopted in extending the company's business. He was certain that in the future companies such as Dick, Kerr and Company would have to meet competition that would arise by combination and absorption, and he congratulated the board on having absorbed or amalgamated with Willans and Robinson and the United Electric Car Company. There was an old saying that any industrial concern which stood still was going back, not by virtue of standing still, but by virtue of its competitors gradually outstripping it, and he wished to support the policy that the board had adopted in gradually extending. As far as he knew this was the first industrial company in this country which had adopted the policy of acknowledging its officials by constituting them a management committee. He was perfectly certain that by taking the staff into their confidence, as obviously they were doing, the directors were very much strengthening not only their own position but the position of the company as a whole. In conclusion, he wished particularly to mention the name of Mr. Rutherford, the managing director, who was very largely responsible for the success which the company had achieved.

Mr. PARKER seconded, and asked if it was contemplated to pay interim dividends on the ordinary shares.

The motion was carried by acclamation, and

The CHAIRMAN, in reply, thanked the shareholders for their expression of confidence and approval. He could hold out no hope of the payment of interim ordinary dividends, as the work that would be thrown upon the already overpressed auditors forbade that course. He pointed out that the work accomplished by the managing director was exceptional, and it was marvellous what had been done. They all appreciated the kind words of the mover and seconder.

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The report for the 12 months ended June 30, 1917, which was adopted by the meeting, states that the company has again had a very prosperous year. A dividend of 10 per cent. per annum is recommended on the ordinary shares and £36,073 is carried forward. The previous dividend was 6 per cent., and £20,397 was carried forward. As a year ago, a special reserve of £25,000 has been made for contingencies. The profits amounted to £95,465, and including the amount brought forward there is a total sum available of £115,862, which has been allocated as set out in the table below, in which a comparison is given with the results of the four preceding years:—

| | 1917. | 1916. | 1915. | 1914. | 1913. |
|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ |
| Net profits ... ... | 95,465 | 71,740 | 46,959 | 44,761 | 30,092 |
| Balance from last year... | 20,397 | 18,347 | 25,526 | 10,325 | 10,016 |
| | 115,862 | 90,087 | 72,485 | 55,086 | 40,108 |
| Debenture interest and trustees' fees ... | 10,188 | 10,490 | 10,538 | 10,961 | 11,183 |
| Premium on debenture stock redeemed ... | 300 | 300 | 300 | 300 | 300 |
| Dividend on 6 per cent. preference shares ... | 18,300 | 18,300 | 18,300 | 18,300 | 18,300 |
| Dividend on ordinary shares ... | 26,000 (10%) | 15,600 (6%) | — | — | — |
| Reserve against contingencies ... ... | 25,000 | 25,000 | 25,000 | — | — |
| Balance carried forward | 36,073 | 20,397 | 18,346 | 25,525 | 10,325 |

Although the amount of excess profit levy under the Munitions of War Act has not been finally settled, the directors believe that the reserves which they have made in the accounts for extra depreciation, special taxations, etc., are sufficient. The work carried out during the year by all departments on behalf of the Government has been of even greater magnitude than in any preceding year. The national factory, to which reference was made in the previous report, has been completed and organised and was handed over to the Government as a going concern in July last thus releasing a large number of the company's staff for development work in other directions. The company has acquired control of the United Electric Car Company's undertaking by the purchase of the greater part of the issued preference and ordinary shares in that company. Steps have been taken to amend the articles of association of the Car Company so as to enable Dick, Kerr and Company, Limited, to retain control so long as it continues to hold the ordinary shares. The directors therefore intend to dispose of the preference shares so as to replace the capital of the company temporarily invested therein. Before offering the shares for sale elsewhere, the directors invite applications from share and debenture holders of Dick, Kerr and Company, Limited, for the purchase of these preference shares at par. The capital of the United Electric Car Company consists of £100,000 in 7 per cent. cumulative preference shares of £1 each, and £150,000 in ordinary shares of £1 each, making a total of £250,000 issued share capital. No debenture stock has been issued. The works of the Car Company are situated at Preston, adjoining the works of Dick, Kerr and Company, and can be very conveniently operated under one management. The output will be sold through Dick, Kerr and Company's selling organisation, and it is expected that a considerable increase in business and reduction in expenses will result.

## FINANCIAL REPORTS AND MEETINGS.

**Straker-Squire, Limited,** have declared an interim dividend of 1s. per share.

**Sao Paulo Light and Power Company** announce a dividend of 2½ per cent. on the common stock.

**Babcock and Wilcox, Limited,** are paying an interim dividend of 6 per cent., the same as a year ago.

**Shanghai Electric Construction Company** are paying an interim dividend of 5 per cent. (10s. per share).

**Rio de Janeiro Tramway, Light and Power Company** announce a dividend of 1¼ per cent. on the capital stock.

**Calcutta Tramways.**—The directors have paid an interim dividend on ordinary shares at the rate of 2½ per cent., free of tax.

**Lancashire Dynamo and Motor Company.**—A dividend of 5 per cent. (actual) on ordinary shares, free of tax, is announced.

**Buenos Ayres Tramways Company** announce a dividend of 1s. 3d. per share (5 per cent. per annum) for the three months ended September 30.

**Montreal Heat, Light and Power Company, Limited,** have declared a dividend of 2 per cent. on the paid-up capital stock for the quarter to October 31.

**The Grimsby Electric Vehicle Company, Limited,** has been registered with a capital of £5,000, to undertake the manufacture of electric vehicles.

**Lima Light, Power and Tramways Company** have declared a dividend of 1¾ per cent. in Lima on the shares payable against coupon No. 14 in London.

**Brisbane Electric Tramways.**—An interim dividend at the rate of 8 per cent. per annum (4s. per share), free of income-tax, has been declared on ordinary shares for the past half-year.

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**Hurst, Nelson and Company, Limited.**—The profits for the year ended July 14 were £78,770, and £14,989 was brought forward. A dividend of 10 per cent., and a bonus of 2½ per cent., is proposed on ordinary shares, free of income-tax, adding £20,000 to the reserve, and £18,074 to the depreciation fund.

**Bolckow, Vaughan, and Company, Limited.**—The trading profits for the year ended June 30, 1916, after providing for depreciation and estimated liabilities under the Excess Profits Duties and Munitions Levy Acts, were £510,185, and £135,707 was brought forward. Debenture interest absorbed £34,495, and dividends amounting to 11 per cent. were paid on ordinary shares. It is proposed to add £159,520 to the reserve (raising that fund to £250,000), and to carry forward £126,180. The board recommend a further distribution of 8½ per cent. for the past year on ordinary shares, making 12 per cent. for the twelve months. For 1914-15, the trading profit was £223,315, and the dividend 6 per cent. Owing to the new Finance Act having superseded the financial provisions of the Munitions of War Act, and to a further complication having been introduced by the Government taking control of the coal mines, the directors are obliged to defer the presentation of the balance sheet for the year ended June 30, 1917.

**Paying Wages out of Capital.**—Presiding at the ordinary meeting of the Dumbarton Burgh and County Tramways Company, in Edinburgh, on September 12, Mr. George Balfour said that he viewed with the gravest apprehension the position in which this country would be placed as soon as the short burst of activity immediately following the war operations had passed away. The great mass of industrial workers in this country were being unfitted to stand the shock which must come, and the blame rested not so much with the workers as with those in authority, who, through lack of knowledge or lack of a sense of responsibility, either encouraged or acquiesced in conditions which were economically insupportable. They seemed to lose sight of the fact that at the present moment the greater portion of the wages distributed in this country was provided out of the capital funds of the country, and while this was inevitable in war time, it was a process which could not continue for many years without vitally sapping our national strength.

**Wallasey Corporation Tramways.**—The receipts for the year ended March 31, 1917, amounted to £70,756, an increase of £4,435, the receipts per car-mile being 13·58d., as compared with 12·92d. Working expenditure, including £2,749 war allowances to employees, was £45,861, or 8·80d. per car-mile, compared with £44,569, or 8·68d. per car-mile, or a net increase of £1,292. This amount is made up of various items, additional wages accounting for £1,050. The net revenue, together with £1,938 brought forward, was £27,025. After providing for capital charges, including interest, £6,462; sinking fund, £4,099; and instalment of loans, £1,106, the balance of £3,000 was passed to the depreciation and renewals fund, £8,500 was paid to the general district rate, and £3,858 carried forward. The passengers numbered 15,125,641, an increase of 819,020, and the mileage run 1,249,807, or 18,338 miles in excess of 1916. Mr. R. R. Greene, general manager, remarks that the receipts constitute the highest in the history of the undertaking, and indicate its continued and steady progress. It has been possible during the year to effect only necessary repairs in maintenance and upkeep of rolling stock, and the manager warns the committee that a large amount will have to be expended when normal conditions return.

**Blackpool Corporation Tramways.**—For the year ended March 31, 1917, Mr. Charles Furness, borough electrical engineer and tramways manager, reports that the income amounted to £96,224, and working expenses to £55,085, leaving a gross profit of £41,139, which has been allocated as follows:—Interest and sinking fund charges, £19,956; reserve fund, £2,183; permanent way renewal fund, £9,000, leaving £10,000, which has been paid in aid of rates. The sum so contributed is equivalent to 24·3 per cent. of the gross profit. After providing for interest and sinking fund charges, the available surplus represents 6·67 per cent. on the capital outlay. Total receipts show an increase of 20·2 per cent.; working expenses, 22·3 per cent.; gross profit, 17·4 per cent.; and net surplus, 30·2 per cent. Passengers carried amounted to 3,224,087, or 22·1 per cent. more than in the previous year. The revenue is the highest in the history of the department, but the net profit is only the second best, falling short of the 1914 record by £3,300. Referring to expenditure on the permanent way, Mr. Furness remarks that too much emphasis cannot be laid on the necessity of building up a very substantial fund, as extensive renewals cannot be carried out under present circumstances or probably for some time to come.

**Bradford Corporation Tramways.**—In his nineteenth annual report, Mr. C. J. Spencer, general manager, remarks that although the difficulties of operation have been increased owing to the restricted lighting of the cars and streets, the replacement of employees who have left to take up military duties, and the limited supply of material, a considerably larger number of passengers has been carried. The drain upon the staff has been met in the main by the employment of women. The expenses show an increase of £8,816, and the allowances to dependants of employees have increased by £6,013, to £14,351. The revenue for the year ended March 21, 1917, amounted to £356,025, and working expenses to £267,460, leaving a gross profit of £88,565, an increase of £1,893. After payment of interest and sinking fund and other charges, and allowances for reserves and renewals, £3,400 has been appropriated to the city funds in relief of rates. The appropriation the previous year was £25,000. The traffic revenue, excluding the railless system, amounted to £326,406 against £314,486 last year, an increase of £11,920. Although there was a decrease in the car-mileage of 148,210, or 2·5 per cent., the revenue increased 3·79 per cent., raising the receipts per car-mile from 12·842d. last year to 13·674d. The cost of labour has risen to 58 per cent. of the total expenditure. The effect of the restricted staff and the difficulty of procuring material is shown by the decrease of £9,344 in the cost of repairs to cars. Mr. Spencer remarks that if commodities and rates of pay remain at their present high level the question of raising fares will have to be considered in the future. Large sums of money will be required to restore the undertaking to its pre-war level, and the manager impresses upon the committee the necessity of building up the reserve funds to meet the inevitable position after the war.

## CONTRACTS AND ORDERS.

**Dublin Corporation Electricity Committee** have accepted a tender for a Green's economiser.

**British Insulated and Helsby Cables, Limited,** have an order for the supply of trolley wire to Glasgow Tramways Committee.

**British Hele Shaw Patent Clutch Company's** offer of 162 steel pinions at £212 has been accepted by Bradford Corporation.

**Messrs. Gabriel and Company,** of Birmingham, are supplying brake ratchets and bell springs to Portsmouth Corporation Tramways.

**Mellowes, Limited,** are carrying out glazing repairs at the central car repair depot of the London County Council Tramways at a cost of £623 18s. 3d.

**The Sterling Boiler Company's** tender for boiler equipment with stoker, fans, chimney, etc., at £19,822 has been accepted by Wolverhampton Corporation.

**The Ocean Accident and Guarantee Corporation** have agreed to insure four additional Austin wagons belonging to Marylebone Council against all risks at an annual premium of £12 each, less 15 per cent.

**Wolverhampton Corporation** have placed the following orders:—British Thomson-Houston Company, Limited, 5,000-KW. turbo-generator at £17,803; Allen and Company, condenser body at £6,083; Willans and Robinson, Limited, condenser plant auxiliaries, at £3,729.

**Rotax Motor Accessories Company, Limited,** are supplying a rolling mill to London County Council at £120 in connection with the production at the central car repair depot of hard-rolled copper strip for controller segments and fingers required in connection with the repair of tramcars.

**Bradford Electricity Committee** have placed a contract with Parsons and Company, Limited, for a 12,000-KW. turbo-generator at £45,775. The Council have also decided to place an order without delay for a condenser. It was stated at a meeting of the Corporation on October 28 that the plant at Valley Road station is at present fully loaded.

**London County Council Tramways.**—The following firms have executed the re-winding of armatures for car motors:—The Manchester Armature Repair Company (£610); Johnson and Phillips, Limited (£300); Home and Rowland (£206 17s.); H. Dunn and Son (£51); British Westinghouse Electric and Manufacturing Company (£167 10s.); the Magic Appliances, Limited (£96). Tenders for the supply of 3,724 yards of trolley wire have been received from the British Insulated and Helsby Cables, Limited, £396 2s., and from Frederick Smith and Company, £398 17s. The former was accepted. The Highways Committee have reported to the Council the following particulars of various works for which they have arranged in connection with Greenwich generating station:—

(1) Purchase for £20 16s. 4d. from J. Hopkinson and Company, Limited, of two valves for repairing boilers.
(2) Purchase for £64 10s. from the Power Plant Company, Limited, of two sets of double helical gears.
(3) Purchase from the British Westinghouse Electric and Manufacturing Company, Limited, of a steam chest for No. 1 turbo-alternator for £177 10s., this being one-half the cost, subject to the old steam chest castings becoming the property of the company. Further expenditure of £20 sanctioned for fixing the chest.
(4) Purchase for £235 10s., from Babcock and Wilcox, Limited, of a set of stoker links for the boilers.
(5) Repair for £53 19s. 4d. by the Electric Construction Company, Limited, of a motor and choker and switch.
(6) Purchase for £43 from the British Westinghouse Electric and Manufacturing Company, Limited, of a high-pressure gland with paddle wheel casing for turbo-generators.

During the recess the following tenders were received for the supply of electric cables:—Western Electric Company, Limited, £1,430 (accepted); W. T. Henley's Telegraph Works Company, Limited, £1,462; Callender's Cable and Construction Company, Limited, £1,469; British Insulated and Helsby Cables, Limited, £1,480; Johnson and Phillips, Limited, £1,480; Siemens Brothers and Company, Limited, £1,490; W. T. Glover and Company, Limited, £950 (part only). The following tenders were accepted for the supply of 1,500 driving wheel and 750 pony wheel tires for tramcars:—Brown, Bayley's Steel Works, Limited, £7,294 7s. 6d., and the Patent Shaft and Axletree Company, Limited, £7,990 12s. 6d.

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## PERSONAL.

**Mr. M. Bell** has been appointed superintendent at West Bromwich generating station at a salary of £300 per annum.

**Mr. H. Dickinson,** city electrical engineer, Liverpool, has been granted an increase in salary from £1,500 to £1,600.

**Sir Boverton Redwood,** director of petroleum research, has been appointed director of technical investigation in the Petroleum Executive.

**Mr. Sydney Morse,** owing to the Government having requisitioned his offices at No. 1, Kingsway, has removed to 79, Queen Street, Cheapside, E.C.4.

**Mr. H. S. Ellis,** electrical engineer of South Shields, has been given permission to accept the appointment of Coal Controller's representative for the district.

**Councillor A. M. Jarmin,** who has accepted the mayoralty of Ipswich for the ensuing year, has done much useful work as chairman of the Tramways Committee.

**Mr. Henry Clayton** has been recommended by Preston Corporation Tramways Committee for appointment as assistant engineer and manager at a salary of £200 a year.

**Mr. H. R. Docker,** second class assistant in the London County Council Tramways department, has been appointed time tables assistant at a salary of £262, rising to £300.

**Mr. T. Ridyard,** rolling stock and works superintendent, Liverpool Corporation Tramways, has been granted an increase in salary from £400 to £500, increasing in twelve months to £550.

**Mr. Thomas E. Allan,** of South Park, Lincoln, has joined the board of Robey and Company, Limited. Mr. Allan has been associated with the management of the company for some time.

**Mr. James Briggs,** assistant engineer of the Midland Railway Company, has been appointed chief engineer to the company, in succession to Mr. W. B. Worthington, who has retired owing to ill-health.

**Mr. T. Coole,** engineering assistant in the Liverpool Corporation Tramways department, has been granted an increase in salary to £500 per annum, with a further £50 a year hence, a total increase of £150 on his present salary.

**Mr. H. W. Woods,** senior charge engineer, Manchester Corporation electricity department, has been appointed a charge shift engineer at Greenwich power-station of the London County Council Tramways at a salary of £250, rising to £300.

**Sir Maurice Fitzmaurice, C.M.G.,** has been appointed to fill the vacancy on the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research caused by the retirement, by rotation, of Mr. W. Duddell.

**Mr. F. H. Corson,** electrical engineer and manager, Gloucester City Tramways, has been appointed local representative of the Coal Controller in the West of England. The Electricity Committee congratulated Mr. Corson on the appointment.

**Doncaster Corporation** have granted increases of £50 per annum to Mr. G. A. Roberts, acting electrical engineer, and Mr. T. Potts, acting traffic manager of the tramways, during the absence of Mr. E. S. Rayner, the manager and electrical engineer.

**Mr. W. B. Worthington,** engineer-in-chief of the Midland Railway Company, having, from considerations of health, resigned the presidency of the Institution of Civil Engineers, Mr. Harry E. Jones, the vice-president, has been elected president for the year 1917-18.

**Mr. E. P. Austin,** who has been chief engineer at Chesterfield Corporation Electricity Works since 1906, has been appointed chief electrical engineer at the Sheep Bridge works. In accepting Mr. Austin's resignation, the Electricity Committee recorded their appreciation of his energy and ability.

**Mr. N. Bradwell,** who has been in the service of Sheffield Corporation Tramways for sixteen years, has been elected assistant general secretary of the Amalgamated Association of Tramway and Vehicle workers. Four candidates competed for the post, and out of 32,000 votes Mr. Bradwell was awarded 24,686.

**Sir Francis Hopwood,** upon whom the King recently conferred a peerage, has assumed the title of Baron Hopwood of Rosyth. Sir Francis Hopwood, after being private secretary to the President of the Board of Trade, became secretary of the Railway Department in 1893, and held the position of permanent secretary to the Board from 1901 to 1907.

**Mr. R. C. Bullough,** general manager and engineer, Colchester Corporation Tramways, was recently granted an increase in salary. The Council also adopted a recommendation by the Tramways Committee congratulating Mr. Bullough on the efficient working of the tramways during the greatly increased traffic of the last three years, and expressing satisfaction at the freedom from serious accidents and the greatly improved revenue.

**Alderman J. H. Hargreaves,** who for many years, until a year or so ago, rendered great service to Hull Corporation Tramways as chairman of the committee, was on October 22 presented by the citizens with his portrait. The Alderman was the first Lord Mayor of Hull, which position he occupied for three years, resigning his chairmanship of the Tramways Committee in the third year owing to the strain entailed on the mayoral duties by war work. The fund for the presentation amounted to about £800, and the ex-Lord Mayor was also handed an ebony walking stick, gold mounted, and bearing the city arms. Mrs. Hargreaves received a diamond ornament.

We regret to record the death of **Mr. Frank Woodhead,** rolling stock superintendent of the Walsall Corporation Tramways and motor department. Mr. Woodhead had held the appointment since September, 1903, and was formerly on the engineering staff of the Bradford Corporation Tramways.

**The Late Alderman J. Brodie.**—Mr. Charles Furness, general manager of Blackpool Corporation Tramways, in his report for the past year, alludes to the late Alderman Brodie, and states that he occupied the position of chairman of the Tramways and Electricity Committee uninterruptedly from 1896 to his death, and during this time played a prominent part in the administration of these departments. He was proud of his long association with these undertakings, and their prosperity and success are to a large degree due to the staunch support the officials always received from him. His genial presence will be sadly missed.

### WITH THE FORCES.

**Pioneer J. Fetter,** signal section, Royal Engineers, who has been awarded the Military Medal, was an employee of Aberdeen Corporation Tramways Department.

**Lance-Corporal Alex Brown, R.E.,** formerly an electrician with Dick, Kerr and Company, Ltd., at Preston, has won the Military Medal. The distinction was awarded for laying a cable under heavy fire.

**Sergeant H. W. Hughes,** Royal Warwickshire Regiment, formerly a motorman on Birmingham Corporation Tramways, at the beginning of the war enlisted in a Territorial Force battalion of the county regiment. In 1915 he took part in the fighting in France, and at the battle of the Somme he was wounded. On recovery in England, he returned to his battalion last November, and in February of the present year he was recommended for a commission, which was bestowed after he had passed a course of instruction.

**Second-Lieutenant A. E. Conibear,** King's Liverpool Regiment, who has died from wounds received in action in France on September 20, previous to the war was a Bristol tramways conductor.

We regret to learn that a son of **Mr. W. B. Cownie,** managing director of the National Electric Construction Company, Limited, has been killed. He was attached to the Royal Flying Corps.

**Lance-Corporal J. Walmsley,** Loyal North Lancashire Regiment, who was awarded the Military Medal in July, has been killed in action. He was formerly employed at the Preston works of Messrs. Dick, Kerr and Company, Limited.

## REGULATION OF LONDON CARS IN AIR RAIDS.

At a meeting of London County Council on October 16, Mr. G. H. Hume, chairman of the Highways Committee, in answer to questions, stated that it was in compliance with an order issued in November, 1916, by the Field Marshal Commanding the Home Forces, that drivers and conductors had been required to continue their journeys during air raids. In view of recent experiences, however, it had been arranged that cars might be brought to a standstill, and the motormen and conductors might take cover during gun fire in the vicinity.

The following notice to motormen and conductors was subsequently issued by Mr. A. L. C. Fell, general manager :—

I am now instructed by the Commissioner of Police to state that in view of the recent experiences it has been decided, with the assent of the Field Marshal, that notwithstanding Section 2 of the Order made on November 2, 1916, embodied in General Orders Nos. 683 (amended) and 685, cars may be brought to a standstill, and the motormen and conductors may take cover after, but not before, anti-aircraft gunfire is heard *in the vicinity*, and after the following instructions have been carried out :—

(1) Should any car be on a gradient it must be driven to a section of track which is comparatively flat.

(2) Cars must not be close poled.

(3) Cars must not be left at intersections of crossing streets.

(4) The hand brake of the cars must be applied to the fullest extent, and the brake ratchet wheels dogged.

(5) The controller handles must be removed if a motorman leaves his car to take advantage of the nearest cover.

Motormen and conductors should rejoin and proceed with their cars as soon as gun-firing has ceased *in the vicinity*.

I confidently appeal to the patriotism of all affected by this notice to make these arrangements a success. It is of the greatest importance in the national interest that the tramway services, which are essential for the transport of munition workers and the public generally, should be maintained if possible, and in any case resumed with the utmost despatch when the danger is over.

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# TRAMWAY AND LIGHT RAILWAY NOTES.

## BOLTON.

SIX-DAY WEEK FOR EMPLOYEES.

The Tramways Committee have authorised the general manager to prepare a scheme for six days' work for all employees in the department.

## BIRKENHEAD.

THE COLLECTIONS FOR WAR OBJECTS.

During the past 23 months, the amount received through collections on the Birkenhead tramcars on behalf of various charities amounted to nearly £4,400.

## BOURNEMOUTH.

LONG DISTANCE PASSENGERS.

Christchurch Council have asked Bournemouth Tramways Committee if anything can be done to prevent the displacing of through passengers by people who use the cars for short journeys. A reply has been sent that the committee have no power to prevent passengers travelling who require to go short distances only, and that as soon as more motormen are available a larger number of cars will be run. A Bournemouth newspaper adds that a "twopenny fares only" plan has been adopted with regard to cars running along Lower Parkstone route, and that the plan is not popular.

## BRADFORD.

ANNUAL HOLIDAY OF THE OVERHEAD STAFF.

The recommendation of the Tramways Committee that the overhead staff in the tramways department should be allowed a fortnight's annual holiday, commencing next year, instead of a week as at present, has been approved by the War Wages Committee, to which it is referred.

## DUBLIN.

COMPENSATION TO COMPANY.

Mr. Duke, replying to a question in the House of Commons on October 25 by Mr. Nugent, said that the sum of £1,820 5s. 6d. had been paid to the Dublin United Tramways Company in respect of material damage to their property during the rebellion, including buildings, their contents, wiring, pillars, and permanent way. The Property Losses Committee was precluded by its reference from entertaining claims for loss of wages of employees, and there were no funds at the disposal of the Irish Government for making such claims. The only tribunal competent to consider a claim of this character was the Defence of the Realm Losses Committee, and he understood that it would shortly hear a claim which was regarded as a test case.

## HULL.

COMPARISON OF RECEIPTS PER MILE—NIGHT SERVICE AS AID TO PUBLIC SAFETY.

A statement has been presented to the Tramways Committee by Mr. W. J. McCombe, the manager, showing receipts per mile run after 10.45 p.m. on weekdays and 10 p.m. on Sundays. The average earnings are 5·96d. per car-mile, while the working charges average 6·9d. Mr. McCombe pointed out the fact that there were other periods when cars were not running at a profit; this is found to be the case between 10 a.m. and noon, and between 3 and 5 p.m., practically the same service being run during both periods. It had been suggested that the cars should cease running at 11 p.m. on weekdays and 10 p.m. on Sundays. Councillor Exley thought that it would be safer for the public and the employees if the cars stopped earlier; but Councillor Raine, deputy chairman, considered it better to get the people off the streets, and that was the reason for continuing the present service. It was agreed that no change should be made.

## IPSWICH.

HIGH COST OF MATERIALS.

In his report for the past year, Mr. Frank Ayton, general manager of the Corporation tramways, cites the following examples of the increased cost of materials:—Lubricating grease, 89 per cent.; oil for cars, 123 per cent.; steel tires, 255 per cent.; armature coils, 89 per cent.; copper trolley wire, 110 per cent.; stranded steel wire, galvanised, 60 per cent.; and steel check rail bars, 120 per cent.

## LEEDS.

INCREASED CAR LIGHTING.

By the permission of the Home Office, an improvement has been effected in the lighting of the Leeds cars by the alteration and removal of some of the shades around the lamps.

## LIVERPOOL.

CLAIM FOR NEGLIGENCE IN FALL OF A WIRE.

In the Court of Passage, Liverpool, on October 25, Judge Taylor gave judgment in an action in which a woman claimed damages for injuries sustained from part of a falling overhead wire. The judge said the mishap occurred at a section insulator. For plaintiff, an expert said there was no explanation except that the copper screw had not been tightened, and that, therefore, it had become unscrewed by passing traffic or by vibration. The Corporation expert held that it was wrong to draw that inference, and that one ought to assume that some accident had happened. That no accident of the kind had happened before was, the judge thought, extraordinary when one considered the years the system had been working. The mishap was not due to negligence, he was satisfied, and he gave judgment for defendants.

## LONDON.

EXPERIMENTS IN WELDING OF TEE RAILS—FOUNDRY EXTENSION TO MEET THE CASTINGS SHORTAGE—PUBLICITY DEVELOPMENT—EMPLOYEES' DEMANDS—ACCIDENT CLAIMS—INCREASED COAL FREIGHT RATES.

The Highways Committee of the London County Council reported on October 30 that they had sanctioned expenditure not exceeding £50 for the installation, for experimental purposes, of a special apparatus for welding conductor tee rails. In view of the serious difficulty in obtaining supplies of castings for the maintenance of rolling stock, the existing foundry facilities at the central car repair depot have been extended, the work involving the provision of a temporary building at an estimated cost of £480, and the supply of machinery at £350, the erection of the building being carried out by the tramways department. Some months ago the Council appointed Mr. T. E. Thomas (commercial superintendent of the District Underground Railway and the London General Omnibus Company) as head of the new depelopment and publicity section of the tramways, at a salary of £800 per annum. The appointment of the staff was deferred. On October 30 the Highways Committee reported that they regarded the present time inopportune for making a permanent appointment of a publicity assistant, and they recommended that, as a temporary measure, a woman be engaged to assist in the publicity work. This step was agreed to. Applications from employees in the traffic, rolling stock, and permanent way branches for increased remuneration have been referred to the appropriate conciliation boards. The traffic employees asked for an increase of 100 per cent. on pre-war rates. Arising from a quarter's accidents in connection with the tramways, 333 claims have been settled, the costs having amounted to about £3,698. In six other cases actions were brought; in three of these a verdict was given against the Council, two resulted in their favour, and one was withdrawn. Owing to increased rates for freight, an additional expenditure of £22,200 will be required for coal for Greenwich station during the current financial year.

## MANCHESTER.

INCREASED FARES NECESSARY.

Two months ago Mr. J. M. McElroy, general manager, Manchester Corporation Tramways, recommended that the Tramways Committee should consider the question of increasing the fares, in consequence of the continued rise in operating costs and the demand of the Finance Committee that tramways should continue to make the same grant in relief of the rates. At the Council's October meeting the Committee were directed by 57 votes to 38 to consider a revision of the fares, although Alderman Bowes, the chairman, said they would first like to know whether the Trading Profits Committee intended to ask for the same amount to continue to be voted to the relief of rates.

## MANSFIELD.

AN EXTENSION OF TIME.

An application has been made by the Mansfield and District Light Railway Company for an extension of time until April, 1921, for the completion of tramway extensions at Sutton-in-Ashfield and Skegby.

## NEWCASTLE-ON-TYNE.

REDUCTION IN STOPPING PLACES—LIBERATING MORE CARS FOR MUNITION WORKERS.

The Tramways Committee have decided upon important alterations in the services. The constant pressure for an increased service for workmen shows no diminution. The management has at the same time to deal with the difficulty of maintaining a regular service in winter, when driving is more dangerous owing to greasy rails, inexperienced drivers and darkened streets, and there is also more danger from drivers of vehicles. The service will be curtailed on certain routes, but an endeavour has been made to rearrange the times so as to provide a more regular service on all routes, while more cars will be liberated for workmen. With this end in view the number of stopping places has been revised with the object of minimising time. The committee are of opinion that the railways must be called upon if anything more is required. The committee ask ladies to do their shopping early in the day, and urge the public to avoid using the cars between 4 and 6 p.m.

## NEWPORT.

LIGHT RAILWAY EXTENSION.

The Light Railway Commissioners have recently confirmed the Newport Light Railway Order, 1917, authorising the construction of a light railway in the county borough of Newport. The line will extend the tramways to the docks and serve important war works which have just been erected.

## OLDHAM.

CARELESSNESS OF MOTORMEN—EMPLOYMENT OF EX-SOLDIERS.

In one recent week two Oldham motormen were dismissed for carelessness, and the tramways department states that nowadays

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there is great deterioration in the material available for training. There were ten collisions with other vehicles in two weeks and five collisions between cars. In order to prevent drivers attaining too much speed and running past passengers, the manager has been empowered to fix a compulsory stop midway between the Black Horse Hotel and Royal Oak Hotel compulsory stops. At a meeting of Oldham Tramways Committee, Mr. Priestley, the manager, reported that the employment of discharged soldiers on the tramways was not having satisfactory results. He said that they did not seem prepared to take the responsibility attaching to the work. Many of them flatly refused to work a full week, on the ground that if they did so their pensions would be stopped. The men were taken on because the staff was so seriously reduced. Soldiers seemed to come back from the army with the idea that there was a place open for them wherever they liked to go. Some of them were not in good health, and that also interfered with their work. The men, however, of whom he complained seemed to be physically fit, but apparently they only wanted to draw sufficient money to keep themselves going along with their pensions. They wanted, in fact, to do as they liked. Several members of the committee expressed regret at the state of matters disclosed.

### PORTSMOUTH.

WOMEN DRIVERS.

Having lost 71 per cent. of their motormen to the Services, the management of Portsmouth tramways have had to restrict the car service. Only a few of the former employees have yet been discharged from the army unfit for further service. These are not in a condition to return to their original occupations, and are being kept on at other work in the department. A last effort is now to be made to secure men who can be trained as motormen, and if it proves unsuccessful the Tramways Committee contemplate employing women as drivers.

### SHEFFIELD.

ADDITIONAL WAR ALLOWANCES TO EMPLOYEES—PERMANENT WAY MAINTENANCE.

The Tramways Committee has recommended that from August 20 an additional war allowance of 3s. per week to male employees and 2s. per week to female employees in the tramways department be granted to all such employees as are in receipt of wages of less than 56s. per week, with the exception of those employees in the engineering trades who recently received the allowance under the award of the Committee on Production. In his report for the year ended March 25, 1917, Mr. W. J. Hadfield, city surveyor, states that the expenditure on tramway permanent way was £23,015, a decrease of £3,040 as compared with the previous year. Several junctions were replaced and 7,664 joints were welded. In addition, 412 joints and 10 points and crossings were repaired by electrically welding steel to the surface of the worn rail ends.

### SWANSEA.

TRAMWAY RENTS.

The Tramways Committee have agreed to the annual rents payable by the Tramways Company being fixed at about £6,000 per year, the Corporation to retain their existing powers regarding repairs, etc. The agreement is to be embodied in the new lease to include the whole undertaking. Under the old agreement several sections had to be re-leased to the company right up to 1980 before the Corporation could exercise its power of purchase, but in 1911 the various periods were equated to one date (about 20 years' time).

### WALSALL.

BOY SCOUTS AS CONDUCTORS.

Walsall Tramways Committee has decided to accept the offer of the service of boy scouts to assist the conductors at the busy times.

### WARRINGTON.

INCREASED EXPENSES.

Alderman Wilkinson at a recent Council meeting discussed the position of the tramway undertaking, and said that while the tramways had held their own without increasing prices until now, the straining point had come. War bonuses had increased to £3,600 per annum. Prior to 1914 the cost per car-mile was 8d.; to-day it amounted to 11½d. per car-mile. On the omnibuses they had been losing money all along. Unless additional revenue was obtained, the deficit would have to be met out of the rates.

### WIGAN.

DAMAGES IN THE OVERTURNED CAR CASE.

Seventeen claims for damages arising out of the accident on the Wigan Corporation tramways on July 26 last year, when a crowded tramcar was ovetrurned and a number of passengers injured, one fatally, came before the County Court Registrar on October 24. A test case had already been brought, when judgment was given in favour of plaintiff for the full amount, £45, and costs. The Corporation appealed, but the judgment was upheld. The damages awarded in the 17 cases amounted to £488 19s., as compared with £642 13s. claimed. Negligence was alleged in allowing the car to be overloaded, driving at an excessive speed down an incline, and failure to maintain the car and the track in proper order.

## PATENT LIST.

**Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.**

***** If the inventions have been communicated the names of the communicators are given below in italics.**

### APPLICATIONS FOR LETTERS PATENT.

Motor vehicles (14,259)—F. J. Brougham (*Mustad*).
Engines for traction on centre rail railways (14,137)—G. N. Fell.
Prevention dead lines at line crossing or junctions on electric tramways (14,169)—W. J. Fenge.
Control of fuel supply to engines of motor vehicles driven by gas (14,183)—A. Halsall.
Driving gear for motor vehicles (14,276)—F. H. Mingay.
Motor vehicles (14,237)—W. Mulholland.
Railroad tie and rail fastener (14,195)—C. E. Peterson.
Lifting jacks (14,173)—F. L. Rapson.
Gas containers for motor vehicles (14,125)—F. A. Wilkinson.
Brakes for motor vehicles (14,535)—E. L. Cornell.
Motor vehicles (14,802)—J. Hanman.
Motor vehicles (14,656)—Humber Limited and S. J. Rodgers.
Control valve for gas bags of motor vehicles (14,843)—J. G. Looker.
Automatic guide light to assist adjustment of tramcar trolley poles (14,511)—R. Mercer.
Hydraulic gears for motor vehicles (14,852)—R. Rutherford.
Paving of tramways (14,763)—W. J. Howard-Smith.
Gas containers for motor vehicles (15,037)—J. H. Barnett.
Gas containers for motor vehicles (15,258)—C. Macintosh and Company and L. Brown.
Coal-gas generating appliances for vehicles propelled by internal combustion engines (14,952)—H. Etchells and H. A. Greaves.
Collapsible gas containers for motor vehicles (15,029)—J. Knape.
Trailer vehicles (14,891)—C. McMullen.
Electro-magnetic friction clutches for driving and change-speed gear for motor vehicles (14,908)—Menco-Elma Syndicate and G. Pollard.
Means for carrying gas upon motor vehicles (14,874 and 15,256)—A. Phillips.
Motor vehicles (15,190)—P. S. Swan.
Radiators of motor vehicles (15,154)—T. Totman.
Gas containers for motor vehicles (15,259)—C. O. Uner.
Means for carburetting or vaporising fuel in internal combustion engines for road vehicles (15,180)—R. P. Walker.
Railway chairs (15,687)—J. Archbold and R. Hutchinson.
Automobile road car (15,337)—B. Averkieff.
Brake and clutch mechanism of locomotives, railway motor cars, etc. (15,500)—Baguley Cars, Limited, and L. Bentall.
Power transmission mechanism of locomotives, railway motor cars, etc. (15,501)—Baguley Cars, Limited, E. E. Baguley and L. Benthall.
Electric trams propelled by overhead wire (15,369)—R. D. Bailey.
Differential gearing for steering motor vehicles (15,303)—G. M. Blackwood, E. Carter, F. Carter, and R. E. Watts.
Trailers for self-propelled road vehicles (15,362)—G. Enderby.
Motor vehicles (15,597)—T. de Estrada.
Combined driving and steering device for motor vehicles (15,410)—H. G. C. Fairweather (*Leffler*).
Signalling systems for railways (15,317)—J. Hardman.
Receptacles for gas under pressure for motor vehicles (15,437)—J. W. Harper.
Radiators of motor vehicles (15,292)—J. Hodgson.
Gas containers for motor vehicles (15,286)—B. Shaw.
Flexible gas containers for motor vehicles (15,390)—A. E. Short and H. O. Short.
Device for stopping runaway tramcars (15,313)—W. A. Staton.
Motor vehicles (15,991)—A. Dunhill.
Air and gas mixer for running motor car petrol engines on gas (15,859)—T. P. Dunkerley.
Light railway locomotives (15,878)—F. H. Dutton.
Collapsible gas containers for motor vehicles (16,041)—G. H. Dutton and J. Knape.
Vacuum brake gear for railway rolling stock (15,906)—W. C. Echlin.
Railway or tram lines (15,800)—K. E. Hall.
Traffic indicator for motor vehicles (15,912)—H. Heron.
Continuous railway brake apparatus (15,831)—H. F. Ward.
Gas containers for motor vehicles (15,869)—G. W. Williams.

### SPECIFICATIONS PUBLISHED.

1916.

In the following list the numbers in italics are those that the specifications will finally bear and under which they will be indexed and abridged before acceptance and finally printed. The application number should, however, still be used for correspondence purposes.

Vehicles for combined road and rail traction (12,975—*109,313*)—W. F. Holt.

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STEAM AND HYDRAULIC
ENGINE PACKING
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And all Engine Room Stores
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In the United Kingdom—Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).
One Shilling per Single Copy. (Postage 2d.)
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Electric signalling systems (13,746—*109,325*)—R. Lambourne.
Fare ticket devices for omnibuses and tramways (13,376—*109,491*)—W. Aitken.
Motor vehicles (16,020—*109,529*)—Daimler Co. & F. W. Lanchester.
Appliance for taking moulds of rails *in situ* (18,502—*109,554*)—A. Woodhill.
Car door fasteners (8,880—*109,630*)—G. E. Merritt.
Fuel supply for motor vehicles (13,864—*109,669*)—T. A. and T. H. Barton.
Live axles of motor cars (16,373—*102,489*)—Soc. C. Blum et Cie.
Differential bevel gearing for use in electro-mechanical variable speed mechanism (9,172—*109,816*)—J. G. P. Thomas and Thomas Transmission, Limited.
Means for the propulsion of motor vehicles (11,216—*109,821*)—H. E. Freakley.
Railway permanent way chair (14,905—*109,859*)—E. Webb.
Steering mechanism for motor vehicles (18,346—*103,117*)—National Manufacturing Company.
Electric lighting and heating of railway vehicles (10,855—*109,985*)—C. H. Vidal.
Motor vehicles (11,756—*109,986*)—F. W. Gunton.
Train controlling apparatus (14,108 and 14,109—*110,016* and *110,017*)—A. F. Bound and W. Rowland.
Speed-changing, reversing and braking gearing (14,117—*110,020*)—G. Pollard and Menco-Elma Syndicate.
Motor vehicles (16,713—*110,051*)—G. M. and H. F. Caufeild.

1917.

Motor road vehicle bodies (199—*109,371*)—S. G. Jacobs.
Wheels for motor road vehicles (3,649—*109,580*)—F. E. Baker.
Front-driven motor vehicles (9—*109,720*)—A. W. Brightmore.
Transmission gear for motor vehicles (55—*109,721*)—E. A. Jern.
Automatic slack adjusters for railway brakes (6,982—*109,045*)—A. R. K. Djurson.

## AN ENCOURAGING OUTLOOK.

Sir Robert Hadfield, chairman of Hadfields, Ltd., Sheffield, holds encouraging views regarding the British steel and other industries, high wages and short hours of labour. Since the war, he says, there have been industrial developments in Britain, France, and Italy that had been regarded as impossible. Industrial England when the war ends will produce 50 per cent. more than when the conflict began, despite the absence of many workers whom the war will have destroyed. On the question of wages and hours, Sir Robert informed a representative of the *Observer*: "We find that shorter hours make good men better and bring the medium workman up to something higher than the old-time average. The war has raised British wages more than it has increased the British cost of living. So, with the shorter hours and better wages, England, with all her fit men eliminated from her industrial machine, is doing the best and biggest work of her life, because she is treating workers better than they have ever been treated in the past.

## Colonial and Foreign Tramways Traffic Returns.

| NAME OF COMPANY. | 1916. WEEKS ENDED. Oct. 7. | Oct. 14. | Oct. 21. | Oct. 28. | | 1917. WEEKS ENDED. Oct. 6. | Oct. 13. | Oct. 20. | Oct. 27. | | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Anglo-Argentine ... ... ... | 54,067 | 53,349 | 53,160 | 52,134 | ... | 55,070 | 53,666 | 53,113 | 53,732 | ... | 43 | 2,218,241 | + 27,698 |
| Auckland .. ... ... ... ... | ... | (28 days) | 21,428 | ... | ... | ... | (28 days) | 22,308 | ... | ... | 17 | 92,118 | + 7,832 |
| Calcutta ... ... ... ... Rs. | 77,886 | 65,344 | 65,035 | 63,346 | ... | 68,907 | 72,288 | 71,493 | 63,364 | ... | 43 | 2,938,287 | + 26,810 |
| Madras ... ... ... ... ... | ... | ... | (2 weeks) | 31,819 | ... | ... | ... | (2 weeks) | 35,418 | ... | 43 | 696,215 | + 32,305 |
| Pernambuco ... ... ... .. | 3,369 | 3,216 | 3,216 | 3,166 | ... | 4,366 | 4,279 | 4,259 | 4,194 | ... | 42 | 163,170 | + 32,635 |

## Companies Issuing Monthly Statements.

| | 1916. May. | June. | July. | August. | Sept. | October. | 1917. May. | June. | July. | August. | Sept. | October. | Wks. | AGGREGATE. 1917. | + or −. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Ballarat & Bendigo .. | 3,854 | 2,794 | 2,704 | ... | ... | ... | 2,991 | 2,849 | 2,593 | ... | ... | ... | 16 | 13,044 | − 35 |
| Brazilian Traction Mlrs | 7304000 | 7178000 | 7429000 | 7405000 | 7138000 | ... | 7864000 | 7642000 | 7795000 | 8064000 | 7925000 | ... | 39 | 68,430,000 | + 5,279,000 |
| Brisbane ... ... ... | 33,150 | 31,390 | 32,880 | 37,900 | 32,530 | ... | 33,340 | 32,475 | 32,720 | 36,925 | 31,600 | ... | 39 | 294,840 | − 2,820 |
| British Columbia $ | 414,215 | 400,814 | 411,847 | 423,738 | 414,811 | ... | 438,919 | 373,029 | 438,378 | 454,425 | 457,709 | ... | 13 | 1,350,512 | + 100,116 |
| Buenos Ayres Lacroze | 40,220 | 36,213 | 38,439 | 36,431 | 37,077 | 39,670 | 40,595 | 38,020 | 38,063 | 39,111 | 33,655 | 39,067 | 17 | 149,879 | − 1,737 |
| Burma ... ... ... | 23,585 | 24,027 | 26,340 | 24,413 | 23,749 | ... | 24,906 | 25,463 | 26,288 | 26,714 | 26,168 | ... | 8 | 52,882 | + 4,720 |
| Cape Town ... ... | ... | ... | ... | 13,394 | ... | ... | 15,867 | ... | 16,067 | 15,480 | ... | ... | 8 | 31,547 | + 4,796 |
| Carthagena & Herrerias | 2,927 | 3,512 | 2,371 | 2,081 | 1,779 | 2,539 | 4,321 | 5,325 | 5,763 | 4,164 | 4,306 | 2,805 | 43 | 41,210 | + 16,071 |
| Cordoba ... ... ... | 14,869 | 14,120 | 14,258 | 13,851 | 13,313 | ... | 13,735 | 14,416 | 14,343 | 14,278 | 12,463 | ... | 26 | 82,895 | − 1,588 |
| East India ... ... | 2,161 | 2,283 | 2,220 | 2,522 | 2,523 | 2,080 | 1,455 | 1,186 | 1,183 | 1,562 | 1,512 | 1,229 | 13 | 4,303 | − 2,822 |
| Kalgoorlie ... ... | 2,921 | 2,500 | 2,521 | ... | ... | ... | 2,692 | 2,648 | 2,713 | ... | ... | ... | 30 | 18,154 | + 696 |
| La Plata ... ... ... | 4,342 | 3,735 | 3,910 | 3,793 | 3,993 | 4,434 | 4,126 | 3,852 | 3,875 | 4,076 | 3,450 | 4,069 | 43 | 40,615 | - 1,441 |
| Lima ... ... ... | 33,966 | ... | ... | ... | 33,340 | ... | 35,321 | ... | ... | ... | 35,621 | ... | 39 | 322,195 | + 18,107 |
| Manaos ... ... Rs. | 152,854 | 144,913 | 152,380 | ... | ... | ... | 158,613 | 165,693 | 162,157 | ... | ... | ... | — | — | — |
| Manila ... ... $ | 53,900 | 59,432 | ... | ... | ... | ... | 61,500 | 73,900 | ... | ... | ... | ... | — | — | — |
| Mexico ... ... $ | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Monte Video ... ... | 28,349 | 25,300 | 25,220 | 26,044 | 26,711 | ... | 28,716 | 27,458 | 28,597 | 28,860 | 29,426 | ... | 48 | 329,679 | + 10,636 |
| Peruvian ... ... $ | 826,900 | 929,500 | 835,430 | 895,900 | 911,910 | 945,590 | 902,780 | 965,420 | 975,000 | 979,430 | 950,740 | 1047220 | 17 | 3,952,390 | + 363,560 |
| Port Elizabeth ... ... | ... | ... | 3,166 | 2,863 | ... | ... | 3,494 | ... | 3,544 | 3,360 | ... | ... | 8 | 6,904 | + 875 |
| Rangoon ... ... ... | 4,589 | 4,205 | 4,357 | 4,253 | 4,137 | 5,043 | 4,737 | 4,383 | 4,783 | 4,788 | 5,163 | 5,667 | 43 | 50,021 | + 3,650 |
| Toronto ... ... $ | 903,924 | 884,491 | 867,789 | 889,241 | 913,535 | ... | 992,460 | 984,529 | 954,192 | 1039819 | 1023517 | ... | 39 | 8,891,112 | + 885,348 |
| Winnipeg ... $ | 276,980 | 254,686 | 242,688 | 249,795 | 267,497 | ... | 259,794 | 254,226 | 242,797 | 248,457 | 267,170 | ... | 39 | 2,431,794 | − 29,660 |

(*Continued on page 344*)

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# TRAFFIC RETURNS—*continued.*

## Tramways and Omnibus Undertakings in the United Kingdom.

| NAME OF COMPANY OR CORPORATION. | 1916. WEEKS ENDED. | | | | 1917. WEEKS ENDED. | | | | AGGREGATE. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct. 7. | Oct. 14. | Oct. 21. | Oct. 28. | Oct. 6. | Oct. 13. | Oct. 20. | Oct. 27. | Wks. | 1917. | Increase or Decrease. |
| | £ | £ | £ | £ | £ | £ | £ | £ | | | £ |
| Aberdare U.D. Council | 442 | 430 | 395 | 407 | 437 | 434 | 467 | 418 | 29 | 12,965 | + 1.107 |
| Aberdeen Corporation | 1.912 | 1,880 | 1.768 | 1,771 | 2,084 | 2.040 | 2,030 | 1,955 | 21 | 46.298 | + 5.209 |
| Accrington Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ayr Corporation | 331 | 300 | 283 | 278 | 504 | 338 | 338 | 327 | 24 | 13,138 | + 1,233 |
| Bath Electric | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Belfast City | 6,147 | 5,950 | 5,755 | 5,756 | 6,999 | 6,848 | 6,788 | 6,985 | 30 | 190,969 | + 19,786 |
| Birkenhead Corporation | 1,596 | 1,598 | 1,585 | 1,547 | 1,724 | 1,777 | 1,811 | 1,793 | 30½ | 55,577 | + 8.270 |
| Birmingham Corporation | 17,079 | 14,725 | 14,766 | 15,133 | 19,634 | 18,837 | 19,149 | 19,037 | 30 | 547,156 | + 51,131 |
| Birmingham Corp. Motor Omnibuses | 960 | 1,058 | 991 | 963 | 1,248 | 1,106 | 1,174 | 1,185 | 30 | 30,932 | + 622 |
| Blackburn Corporation | 1.221 | 1.123 | 1,157 | 1,158 | 1,549 | 1,387 | 1,387 | 1,358 | 30⅞ | 46,518 | + 6,929 |
| Blackpool and Fleetwood | ... | 566 | 442 | 379 | ... | 675 | 526 | 418 | 42 | 40.260 | + 211 |
| Blackpool Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bolton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bournemouth Corporation | 2.223 | 2,118 | 2,033 | 2.050 | 2.483 | 2,396 | 2,455 | 2,418 | 30½ | 81,400 | + 6.106 |
| Bradford Corporation | 6,492 | 6,928 | 6,587 | 6.358 | 7,902 | 7,094 | 9.084 | 7,331 | 30 | 234,075 | + 23.137 |
| Brighton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bristol | 5.217 | 5,085 | 5,014 | 4.830 | 6,269 | 5,645 | 5,729 | 4,034 | 43 | 233,041 | + 20.935 |
| Burnley Corporation | 1.797 | 1,677 | 1,707 | 1.594 | 2,099 | 1,837 | 1,838 | 1,810 | — | — | — |
| Burton-on-Trent Corporation | 321 | 310 | 278 | 285 | 341 | 325 | 315 | 319 | 30 | 9.346 | + 841 |
| Bury Corporation | 1,408 | 1,410 | 1.372 | 1,274 | 1,656 | 1,580 | 1,566 | 1,482 | 30⅞ | 51,124 | + 6,112 |
| Cardiff Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Chatham and District | 1.353 | 1,343 | 1.316 | 1.212 | 1.050 | 1.176 | 1,210 | 1.113 | 43 | 55,420 | + 2.011 |
| Chesterfield Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Colne Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Cork Electric | 540 | 567 | 544 | 494 | 632 | 577 | 567 | 566 | 43 | 23.704 | 1,575 |
| Croydon Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Derby Corporation | 1.190 | 1,180 | 1.148 | 1.115 | 1,279 | 1.222 | 1,210 | 1.253 | 30 | 36.633 | + 1.490 |
| Dover Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin and Lucan | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin United | 7,058 | 6,549 | 6,341 | 6,165 | 7,512 | 6,777 | 6,800 | 6,846 | 43 | 288.749 | + 27.363 |
| Dundee City | 1.439 | 1.394 | 1,347 | 1.355 | 1,641 | 1,505 | 1,507 | 1,488 | 23½ | 36,334 | + 3.343 |
| East Ham Corporation | 1.299 | 1.298 | 1.314 | 1.244 | 1.263 | 1,308 | 1,329 | 1,262 | 30 | 42.732 | + 2,569 |
| Exeter Corporation | 431 | 427 | 394 | 377 | 433 | 396 | 386 | 379 | 30 | 12,455 | — 67 |
| Gearless Motor 'Buses | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Glasgow Corporation | 24.296 | 23.899 | 24.246 | 23,936 | 27,295 | 26,341 | 26,939 | 26.185 | 21⅞ | 564,924 | + 64.389 |
| Glossop (Urban Elec. Supply Co.) | 146 | 146 | 140 | 146 | 177 | 171 | 166 | 168 | 43 | 6,596 | + 600 |
| Halifax Corporation | 2.224 | 2.044 | 2.098 | 2.097 | 2.587 | 2.273 | 2.309 | 2.311 | 29⅞ | 75,443 | + 6,037 |
| Halifax Corp. Motor Omnibuses | 52 | 49 | 51 | 49 | 54 | 51 | 53 | 48 | 29⅞ | 1,446 | — 61 |
| Hastings and District | 1.076 | 960 | 936 | 836 | 1.304 | 1,200 | 1.155 | 1,124 | 43 | 54,486 | + 8.363 |
| Huddersfield Corporation | 2.791 | 2.790 | 2,776 | 2.661 | 3.376 | 2.996 | 3.173 | 3.032 | 30 | 99.980 | + 9,385 |
| Hull Corporation | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ilford U.D. Council | 669 | 678 | 642 | 626 | 678 | 713 | 728 | 694 | 30 | 23.391 | + 2.356 |
| Ilkeston Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ipswich Corporation | 477 | 476 | 441 | 442 | 700 | 665 | 658 | 635 | 30 | 21.398 | + 4.871 |
| Isle of Thanet | 338 | 336 | 292 | 258 | 181 | 195 | 206 | 157 | 4 | 713 | — 511 |
| Kilmarnock Corporation | 180 | 174 | 176 | 177 | 200 | 200 | 206 | 203 | 23½ | 4,681 | + 427 |
| Lanarkshire | 2,485 | 2,416 | 2.289 | 2,449 | 2.974 | 2.883 | 2.980 | 2,958 | 43 | 118,913 | + 18.997 |
| Lancashire United | 2,361 | 1,884 | 1,861 | 1,873 | 2,688 | 2.354 | 2,483 | 2,411 | 43 | 100,858 | + 21,990 |
| Leeds City | 9.902 | 9.909 | 9,692 | 9,585 | 11,428 | 10.521 | 11,023 | 10,783 | 30 | 333.846 | + 33,843 |
| Leicester Corporation | 3.536 | ... | 3.423 | 3,411 | 4,068 | ... | 3.841 | 3,849 | — | — | — |
| Leith Corporation | 886 | 867 | 858 | 842 | 1.089 | 1,024 | 1,049 | 1,017 | 23½ | 25,785 | + 4.546 |
| Leyton U.D. Council | 1,652 | 1,557 | 1,538 | 1,449 | 1,696 | 1,694 | 1,814 | 1,728 | 30 | 57.380 | + 5,964 |
| Liverpool Corporation | 14.619 | 14,943 | 14,479 | 14,265 | 16.843 | 16,212 | 15,917 | 15,925 | 42⅞ | 666,435 | + 59,746 |
| Llandudno and Colwyn Bay | 327 | 317 | 284 | 255 | 370 | 321 | 290 | 271 | 47½ | 16,855 | — 902 |
| London County Council | 50,215 | 49,436 | 48.920 | 47,016 | 52.498 | 52,549 | 55,381 | 53,836 | 29½ | 1,651.816 | +204.437 |
| London General Omnibus | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| London United | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Lowestoft Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Maidstone Corporation | 280 | 221 | 217 | 197 | 300 | 222 | 229 | 215 | 30 | 7,532 | + 690 |
| Manchester Corporation | 19,169 | 19,216 | 18,648 | 18,678 | 21.882 | 20,475 | 21.002 | 20,794 | 30 | 621,480 | + 48,128 |
| Metropolitan Electric Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| National Steam Car | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Nelson Corporation | 201 | 196 | 197 | 214 | 244 | 219 | 219 | 221 | 30 | 7,147 | + 538 |
| Newcastle-on-Tyne Corporation | 7,123 | 7.150 | 7,045 | 6.985 | 8.156 | 7.884 | 8.069 | 7.988 | 30 | 235.707 | + 33.635 |
| Newport (Mon.) Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| New St. Helens and District | 1.170 | 1,075 | 1,041 | 1,085 | 1.427 | 1.224 | 1,266 | 1,249 | 17 | 26,249 | + 6.713 |
| Northampton Corporation | 732 | 721 | 723 | 714 | 898 | 820 | 836 | 865 | 30 | 25,239 | + 3.561 |
| Nottingham Corporation | 4,064 | 4,077 | 4,041 | 3.939 | 4,711 | 4.546 | 4,639 | 4,445 | 30 | 132.282 | + 12.774 |
| Oldham Corporation | 2.313 | 2.468 | 2.382 | 2,214 | 2.839 | 2.840 | 2.690 | 2.650 | 31 | 88.854 | + 10.146 |
| Portsmouth Corporation | 2.745 | 2,686 | 2.526 | 2,465 | 3.041 | 2,599 | 2,730 | 2.581 | — | — | — |
| Preston Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Provincial | 2.281 | 2.373 | 2.251 | 2.134 | 2,680 | 2,267 | 2.344 | 2.335 | 3½ | 9.138 | + 507 |
| Reading Corporation | 930 | 930 | 891 | 859 | 1.222 | 1,120 | 1.088 | 1,086 | 30⅞ | 31.716 | + 5.670 |
| Rhondda Tramways | 1.419 | 1.383 | 1.375 | 1,375 | 1.659 | 1.557 | 1.656 | 1,577 | 43 | 64.391 | + 9.025 |
| Rochdale Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Rotherham Corporation | 1,652 | 1,590 | 1,618 | 1,588 | 1,801 | 1,859 | 1,814 | 1,837 | 30½ | 55,119 | + 7,272 |
| Salford Corporation | 5,488 | 5,413 | 5,420 | 5,231 | 6,421 | 6,515 | 6,536 | 6,311 | 30⅞ | 201,421 | + 32.109 |
| Sheffield Corporation | 10.471 | 10.709 | 10,656 | 10,489 | 12.211 | 12.218 | 11,921 | 12,199 | 31 | 371,561 | + 43.026 |
| Southampton Corporation | 1.820 | 1.771 | 1.726 | 1.623 | 2.323 | 2.143 | 2.269 | 2.144 | 29½ | 61.099 | + 10.172 |
| Southend-on-Sea Corporation | 929 | 833 | 786 | 685 | 622 | 592 | 645 | 622 | 30 | 30.115 | — 803 |
| South Metropolitan Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| South Shields Corporation | 861 | 854 | ... | ... | 965 | 926 | ... | ... | 15 | 27,042 | + 3.009 |
| Sunderland Corporation | 1,655 | 1,668 | 1,630 | 1,625 | 1,820 | 1,873 | 1,831 | 1,830 | 51 | 36.869 | + 5.145 |
| Sunderland District | 656 | 889 | 726 | ... | 811 | 903 | 854 | ... | — | — | — |
| Swindon Corporation | 222 | 209 | 205 | 199 | 296 | 265 | 266 | 258 | 29½ | 8.188 | + 1.973 |
| Torquay Tramways | 648 | 596 | 549 | 519 | 823 | 753 | 684 | 691 | 43 | 28,762 | + 2,499 |
| Tramways (M.E.T.) Omnibus Co. | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Tyneside Tramways and Tramroads | 636 | 639 | 633 | 610 | 912 | 780 | 825 | 787 | 17 | 11,858 | + 3,875 |
| Wallasey Corporation | 1,299 | 1,320 | 1.243 | 1,221 | 1,594 | 1,469 | 1,454 | 1,420 | 30½ | 49,286 | + 5,755 |
| Walsall Corporation | 841 | 842 | 823 | 822 | 1.036 | 1,002 | 1,022 | 990 | 30 | 29,447 | + 3,823 |
| Walthamstow U.D. Council | 1.076 | 1,073 | 1,033 | 993 | 1,088 | 1,075 | 1,111 | 1,068 | 30 | 38.141 | + 3,786 |
| Warrington Corporation | 463 | 514 | 530 | 509 | 592 | 580 | 567 | 570 | 30 | 16,209 | + 1,313 |
| West Ham Corporation | 3.395 | 3.287 | 3.271 | 3.091 | 3.252 | 3.359 | 3,611 | 3.412 | 29½ | 110.348 | + 11.668 |
| Wigan Corporation | 1.775 | 1.724 | 1.736 | 1,726 | 2.072 | 2,000 | 2,114 | 2.310 | 30 | 59,409 | + 8.366 |
| Wolverhampton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Yorkshire (West Riding) | 1,834 | 1.803 | 1.757 | 1.672 | 2.106 | 2,105 | 2,126 | 2,240 | 43 | 91,143 | + 15.361 |

### * TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

### TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.


### THE TRAMWAY AND RAILWAY WORLD

can be obtained, post free, at the following rates:

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Twenty-five Shillings per annum (including 64 issues, of which 12 are large illustrated numbers).

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¶ Daimler Commercial Vehicles have been delivered in great numbers to the War Department.

¶ After the war the majority of drivers will be *au fait* with the famous Daimler Sleeve-Valve Engine.

¶ Their experiences under hard-working conditions will add further testimony to the superiority of the Daimler Product.

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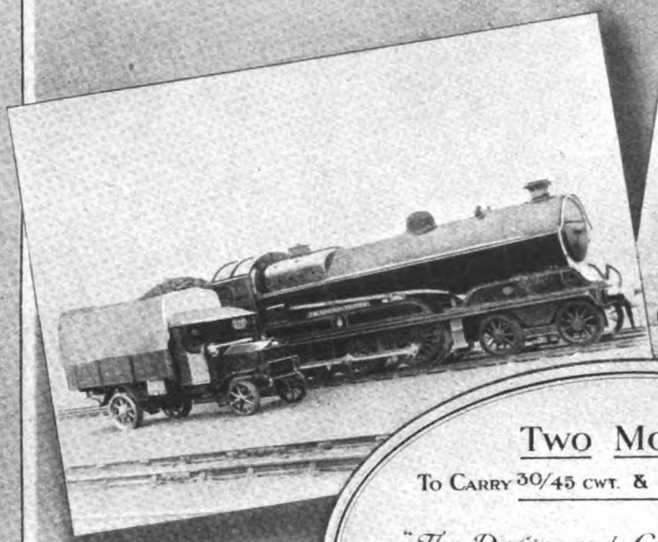
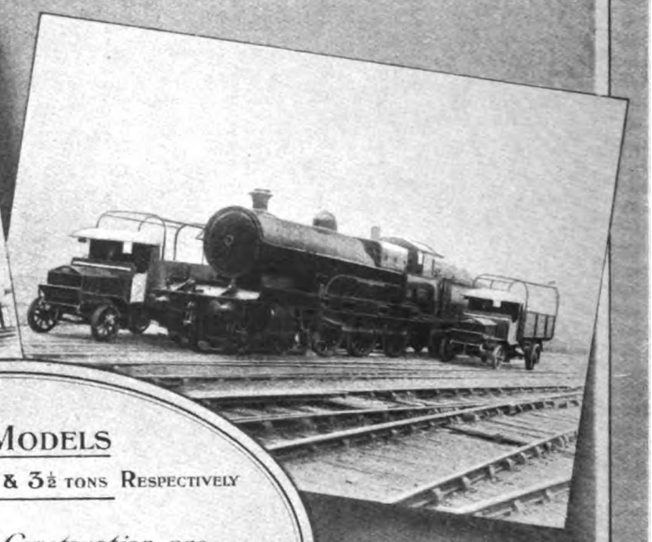
# NAPIER

## MOTOR VEHICLES.





TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

*"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."*

RAILWAY GAZETTE MARCH 31, 1916.

IN PEACE

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

# D·NAPIER & SON LTD.

WORKS
ACTON, LONDON. W

14, NEW BURLINGTON ST. LONDON. W.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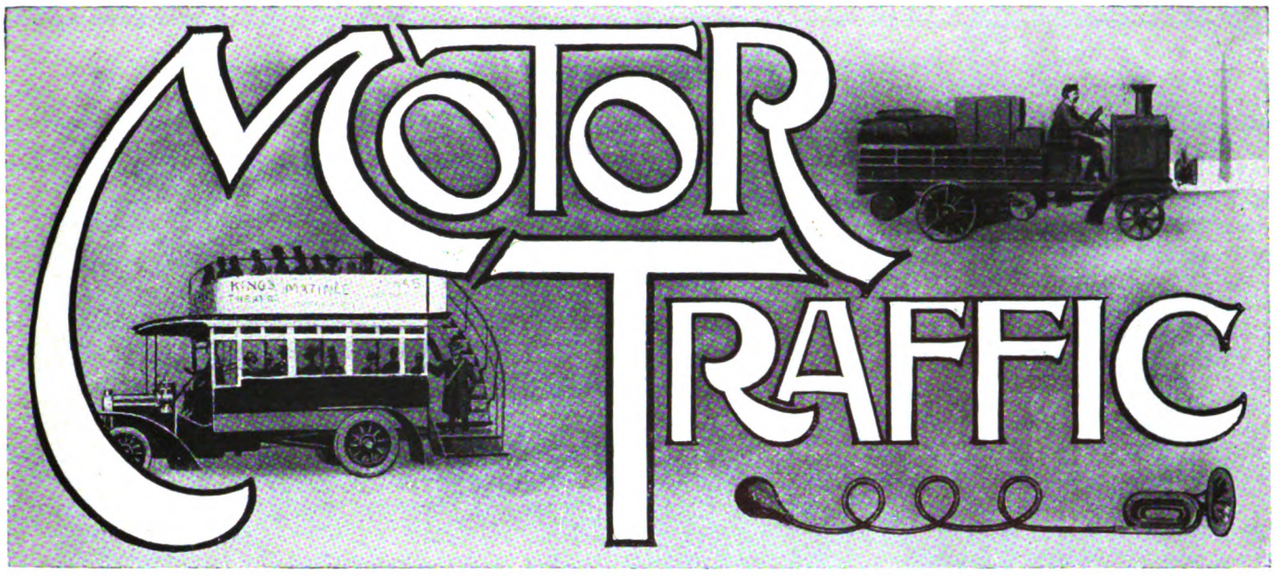


The extension of the use of coal gas as a motor fuel proceeds apace. The first demonstration of vehicles equipped with the necessary fittings for this purpose, which was recently held in London, proved a great success. Although the exhibits, over forty in number, did not reveal any striking novelties, they showed considerable improvement in details. The gas bag can never be a thing of beauty, but undoubtedly its appearance is already far less untidy. The D-shaped bags are much neater than the round ones. The trend is in the direction also of semi-rigid containers and of containers of the concertina type. These improved forms get over the troubles consequent upon the sagging of the original shape of gas bag over the sides of the planking or framework holding it more or less in position. Neater methods of securing the bags have been devised, and there are also several small improvements in the fittings and connections through which the gas passes from the bag to the engine. One new device gets over the possibility of overcharging the gas bag by means of an automatic valve which closes when the bag is filled to the proper extent. Other improvements aim at making the whole installation a more workmanlike job and at preventing the bonnet from being used as a sort of gasometer.

* * * * * *

A development which will be watched with considerable interest is the adoption of the idea of carrying the gas bag upon a trailer. This is simple enough from the mechanical point of view. The main trouble to be anticipated is with the law. A heavy motor vehicle may not draw a trailer at anything above five miles an hour. A motor car, not sufficiently weighty to bring it under the Heavy Motor Car Order, is privileged to draw a trailer which does not weigh more than 2 cwts. unladen without detriment to its legal speed limit, provided that it is possible to reverse with the trailer attached. This provision is met by the gas-carrying trailers now marketed, so that in connection with the lighter classes of vehicle these may prove extremely useful, even though they cannot claim to be particularly elegant. Naturally, reversing is not so simple with the trailer as without it. It is, however, not impossible, and from the point of view of ordinary manœuvring, the trailer does not constitute a very grave inconvenience. The question of whether a similar device will be eligible for use as a carrier of compressed gas cylinders depends entirely on whether the weight of such cylinders is to be regarded legally as part of the weight of the trailer or as part of the load placed upon it. If the former, then the two-hundredweight limit must be exceeded, but if the latter the trailer will afford a quite adequate method of carrying considerable supplies of coal gas fuel in a compressed form. One of the advantages of the trailer as against the gas bag mounted upon the vehicle roof is that the former gets over any difficulty that the latter may engender in the matter of passing through garage doors of limited height. At least one scheme has been brought out with a view to meeting this difficulty in the case of what we may call the ordinary type of coal gas equipment. A subsidiary gas bag, generally empty, is carried either below the roof or against the back of the vehicle, and the gas from the bag on the roof can be passed through into the subsidiary bag when necessary. There is already some talk of the use of coal gas as a fuel for agricultural motors. Certainly, if a huge number of these are to be entirely dependent on petrol, the prospects of dealing with the required acreage before next sowing appear to be somewhat complicated.

* * * * * *

Discussion is in progress as to the advisability of making a milometer a standard fitting of every commercial motor vehicle. The idea is partly to enable the user to keep accurate records of performance and to exert some check upon drivers. It is partly suggested with a view to protecting tyre manufacturers who give mileage guarantees against incorrect estimates of mileage. The main difficulty is to devise a milometer which, while sufficiently accurate, is also sufficiently immune from any form of tampering. So long as it is possible for a driver to play about with a milometer in order, say, to give an unduly high impression of the fuel economy of the vehicle under his charge, it follows that users will be misled as to actual results, and, in turn, will unintentionally mislead tyre manufacturers. Assuming an honest driver, or some means of ensuring that the instrument is left to do its own work without unintentional interference, a milometer is a very useful fitting, the trifling cost of which is well justified. Without it there are almost insuperable difficulties in endeavouring to compare accurately the results obtained by various vehicles of a fleet. Probably, if any standard type be adopted, it will be of a kind that is worked from the gear box without any flexible form of transmission. The question is whether users are sufficiently interested in the matter to give that definite encouragement without which vehicle manufacturers are unlikely to make the milometer a standard fitting.

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# MOTOR TRAFFIC.

With the coming of coal gas, new possibilities are opened up in the way of the establishment of complete charging stations for motor vehicles of all kinds. The principle of the prepayment meter can be used in connection with supplies of gas, electricity, petrol, water, and so on, and it is likely that up-to-date garages will find it worth while to erect installations which will have the effect of making them regular calling places, and therefore of inducing business of other kinds. The police authorities appear to be watching this possibility in a slightly hostile manner. They fear that charging stations may be equipped which will lead to large numbers of vehicles standing in the public roads to take in supplies, and causing obstruction by so doing. This point of view does not appear to be justifiable, since even now time is occupied in filling up, for example, a petrol tank. The adoption of new and improved methods would not increase but would reduce time so spent, and so tend to eliminate rather than exaggerate any obstruction resulting from such a cause. Undoubtedly, the time will come when completely equipped charging stations of the kind indicated will be available at suitable intervals along all our principal roads. The question is whether they will be the result of the private enterprise of garage proprietors, or whether municipal authorities will themselves be long-sighted enough to provide for a growing need in connection with which a reasonable profit can be safely anticipated.

* * * * * *

Hitherto, it has not been possible for the motor user to get any very clear idea of the constituents of the spirit commonly supplied to him, or to judge whether other spirits marketed under different names are in fact pretty much the same as the one he generally favours. As a rule, all that we know about a petrol is the name the importers choose to give it and perhaps its specific gravity. This latter conveys very little real information. If motor spirit consisted of only one hydrocarbon, then, if we knew the specific gravity, we should know all the rest. It is, however, invariably a mixture of a number of hydrocarbons, and it follows that the specific gravity is nothing more than a sort of rough indication of the average of its constituents. Two spirits of the same gravity might be very different in actual quality and efficiency. A suggestion has recently been put before the Institution of Petroleum Technologists to the effect that petrol should be marketed in standard qualities, the standards being determined by suitable tests, not of gravity, but of volatility. If we know at what temperature the lightest fraction will boil, the percentages of the spirit which distil at certain other selected temperatures, and the final boiling point, we can tell pretty well what are the constituents of the spirit. If this suggestion of standard grades could be put into practice we should in all cases have such information. If we could not get our accustomed spirit, we could probably get another of the same grade, and we should know that it would behave in much the same way and give much the same mileage. The innovation would, in fact, be a convenience to motor users, and therefore it is to be hoped that scientists will see their way to agree on the necessary preliminary of standard tests, and will then be able to come into agreement with the other interests concerned as to the number and nature of the grades of spirit that ought to be standardised.

The war has added greatly to the urgency of the problem of the roads in relation to modern traffic, for in many instances the absorption of labour for military purposes renders it a difficult matter to give main roads the minimum of attention. These circumstances, however, cannot be accounted sufficient reason for neglecting the whole question, which will have to be dealt with when happier times arrive. With a view to lightening the wear on the roads, a committee was appointed just before the war to report upon the revision of axle weights, etc., of motor vehicles, but for some reason not disclosed, their report, if presented, is withheld. Traffic has increased enormously in various localities owing to war work, and from places in the neighbourhood of national factories and of military centres demands have been made upon the War Office to meet extraordinary traffic claims. These claims have saved the Road Board from the extinction, for the duration of the war, with which it was unwisely threatened. It has been deputed to deal with these claims and has also supervised the execution of repairs and met the cost. Just prior to the outbreak of the conflict it was agreed by the House of Commons that a committee should be given the task of considering the question of road charges to be paid by heavy motor conveyances, but the investigation does not seem to have been taken up. Towards the end of last year the position was complicated by the passing of the temporary Act authorising a charge to be levied on omnibus owners who desire to use new routes. The result has been that numerous authorities have sought to levy exorbitant charges, a procedure that has stiffened the resolve of the owners to see that the measure is not perpetuated.

## AWARD TO LONDON TRACTION WORKERS.

The Committee on Production have awarded the following weekly increases to London General Omnibus workers:—Drivers and conductors, 4s., inside adult staff, 4s. This award is in addition to the 5s. a week granted to drivers and conductors and the 4s. granted to garage staffs last June. The war wages advances now being paid to engineering labourers working with skilled craftsmen are increaesd to 15s. a week. The following weekly advances have been granted in respect of employees of the Metropolitan, the London United, and the South Metropolitan Tramways:—Men, 4s.; boys and youths under 18 years of age, 2s. In the case of engineering labourers working with skilled craftsmen, the war wages advances now being paid are increased to 15s. per week. The increases are in addition to the advances granted last May. The amounts awarded in each case are to be regarded as "war wages and recognised as due to and dependent on the existence of the abnormal conditions now prevailing in consequence of the war."

## THE USE OF PRIVATE CARS.

On October 31 the President of the Board of Trade issued an order under which private motor cars can be used for business purposes, public duties, journeys to and from a railway station, and in connection with necessary household affairs, provided that no other means of conveyance is reasonably available.

## BREAKING UP CARS FOR WAR MATERIALS.

The Ministry of Munitions are licensing various firms to purchase cars, especially those of the older types, in order to break them up to recover the aluminium, bronze, brass and steel. These materials are sent in to the official smelters to be made into war material. Aluminium is especially needed for aircraft. The upholstering is utilised as rags, and the old tires, woodwork, leather, etc., can all be utilised for purposes connected with the war.

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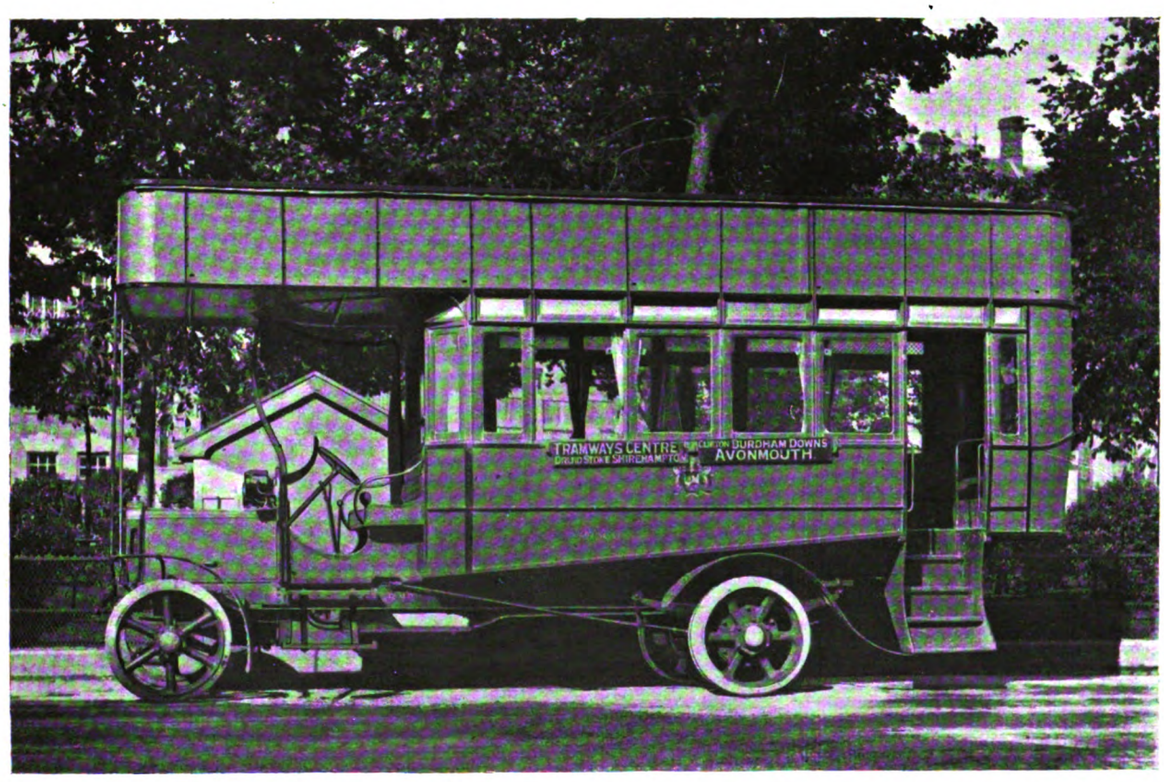
# MOTOR TRAFFIC.

Gas Container Fully Charged—Capacity 850 cubic feet.




Gas Container Deflated.

Bristol Tramways and Carriage Company's Motor Omnibus Equipped for Gas Working.



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# MOTOR TRAFFIC.

## GOVERNMENT AND GAS COMPANIES' ATTITUDE.

The Automobile Association has been in communication with the Ministry of Munitions concerning the use of coal gas, asking for an assurance to the effect that gas may be used without restriction. The Ministry of Munitions has replied that, so long as the gas is conveyed in bags, at or slightly above atmospheric pressure, and not compressed in steel cylinders, it is not considered that there is any need for restricting its use. At the same time, if motorists were to use coal gas on any considerable scale, it might, in the interests of national requirements, become necessary to impose restrictions.

In view of the foregoing reply of the Munitions Ministry, it is desirable that the motor owners should ask that the Government departments should co-ordinate their actions. The Ministry's reply is antagonistic to the hope which Mr. Walter Long recently expressed that as soon as possible many thousands of industrial vehicles will be equipped to run on gas power. Mr. Long added that the saving of petrol has a direct effect on the price of food. Mr. Long's observation is the more important because of his recent appointment as head of the Petroleum Executive. In an announcement issued by the Petroleum Executive it is pointed out that one gallon of petrol suffices to carry three tons of food a distance of only eight miles, which emphasises the importance of substituting gas. Furthermore, the executive have appointed a special committee to keep in touch with the gas fuel movement.

The two departments must realise that gas can only be substituted for coal if the Coal Controller can make arrangements for gas companies to be adequately supplied with coal. Already some companies are charging exorbitant prices for gas supplied to motor vehicles. In one instance 2s. 2d. was the charge for 200 cubic feet, although the charge for lighting is 3s. 4d. per 1,000 cubic feet. The first-mentioned charge is the equivalent of petrol at 2s. 9d. per gallon. Numerous companies have adopted the reasonable charge of 3s. per 1,000 cubic feet. The reason advanced for imposing the higher charge is that the companies are unable to secure sufficient coal to meet the additional demand. This reason conflicts with the frequently uttered exhortation to gas consumers to use gas so as to assist in creating the residuals that are now of incomparable importance in the manufacture of munitions. It is to be hoped that the coal difficulty is not the result of the institution of the Coal Controller's department, but judging by the experiences of householders there is ground for entertaining that suspicion.

## PROGRESS OF GAS TRACTION.

RAPIDLY EXTENDING USE FOR PUBLIC AND PRIVATE CARS.

ROTHERHAM.—The tramways department have resolved to utilise coal gas containers for their omnibuses.

HALIFAX.—The general manager of the Corporation tramways has been authorised to obtain four gas containers to be fitted to the motor omnibuses run by the department.

WALSALL.—The Tramways Committee have purchased gas containers for four motor omnibuses at £23 8s. each. The order followed the carrying out of a trial run in an omnibus belonging to the Corporation.

LIVERPOOL.—It is stated that the Gas Company are not encouraging developments in gas traction owing to the difficulty of obtaining labour to increase the output of gas. The company will not let out meters on hire, and will only sell at a price which is said to be prohibitive except to large garages. It is further asserted that the company state that their legal powers do not permit the supplying of gas for re-selling. Therefore garage owners having a meter can supply only their own vehicles and not those of their customers.

LONDON.—It is satisfactory to find that at least two Government departments, besides numerous private traders, are seeking to obviate the petrol shortage by introducing gas traction. The Royal Naval Air Service and the Navy and Army Canteen Board are running several of their numerous vehicles so fitted. Among the business houses included in the same category are Harrod, Maple, Barker, Whiteley, Lyons, and J. I. Thornycroft, the motor vehicle manufacturers.

LEWISHAM.—The Works and Highways Committee of the Borough Council have recommended acceptance of an offer by Messrs. Lyon, Limited, to supply and fit the Lyon-Spencer gas installation with the necessary fittings and tray, to the surveyor's car at an estimated cost of £43 3s. 6d. At present the surveyor has a licence which enables him to purchase 20 gallons of petrol per month, half of that amount being supplied on the recommendation of the Road Board. This quantity is insufficient, and upon application being made to the Road Board in respect to a further supply, the secretary directed attention to the experiments which have been made for the utilisation of coal gas. The gas bag to be obtained from Messrs. Lyon will be of 275 cubic feet capacity, and its cost will be £29 13s. 6d., while the tray or carrier will cost £16 10s. The cost of petrol for the past year has been about £60.

MANCHESTER.—As indicated in a recent issue of this journal, the Gas Committee of Manchester Corporation have, through their energetic general manager, prepared a scheme for the standardisation of gas-filling arrangements with automatic meters of 100-light size to be operated by metal tokens. Each token will represent 100 cubic feet of gas at the fixed price of 4d. These meters, which will be fitted with a 20-ft. length of 2-in. rubber-packed flexible metallic tubing, are to be fixed free of charge at garages and other places. The tenant will be allowed a rebate of 10 per cent. on all tokens taken from his meter, the driver to do his own filling and connecting, for which there will be working instructions on each meter. The tokens will be stamped with the name of the issuing company, and be interchangeable on a system of cash or credit notes between the companies concerned.

## WAR OPERATIONS OF THE L.G.O. COMPANY.

At the October meeting, which opened the third session of the "Efficiency Meetings" of the London Underground Railways and the London General Omnibus Company Operating Department, there were about 250 members of the control grades present, the chair being occupied by Mr. H. E. Blain, operating manager.

A lecture, "War Time Operations of the London General Omnibus Company, Limited, as seen through the Camera," was delivered by

**One Week's Output of Women Conductors from the L.G.O.C. Training School.**

Captain A. Rosier, superintendent of employment and training. The lecture was illustrated by slides and films, and proved an exceedingly valuable and interesting record of the Company's operations in connection with the war and at home under the influence of war conditions.

Amongst war pictures were L.G.O.C. single-deck omnibuses equipped as ambulances; with the Naval Division at Antwerp, and Boulogne and in France; conveying regulars, London Scottish, Indians, and wounded; whilst other pictures showed L.G.O.C. lorries practically in all parts of the world, and performing all types of work with the army, especially the A.S.C. This portion of the lecture was accompanied by anecdotes of the type frequently read in the war correspondents' despatches in the earlier days of the war, when so extensive a part in solving the army's transport problem was being performed by London omnibuses and their drivers, who drove as unconcernedly amongst shot and shell as in Piccadilly or the Strand.

The home portion of the lecture included the training of mechanical transport drivers, and concluded with an excellent new film showing women's work both on the omnibuses and in the garages, coach factories, etc., whilst another portion of the film depicted clerical operations at the Grosvenor Road offices. Two inspections of the L.G.O.C. special constabulary, which force is 350 strong, and has a motor ambulance attached to it, were also shown.

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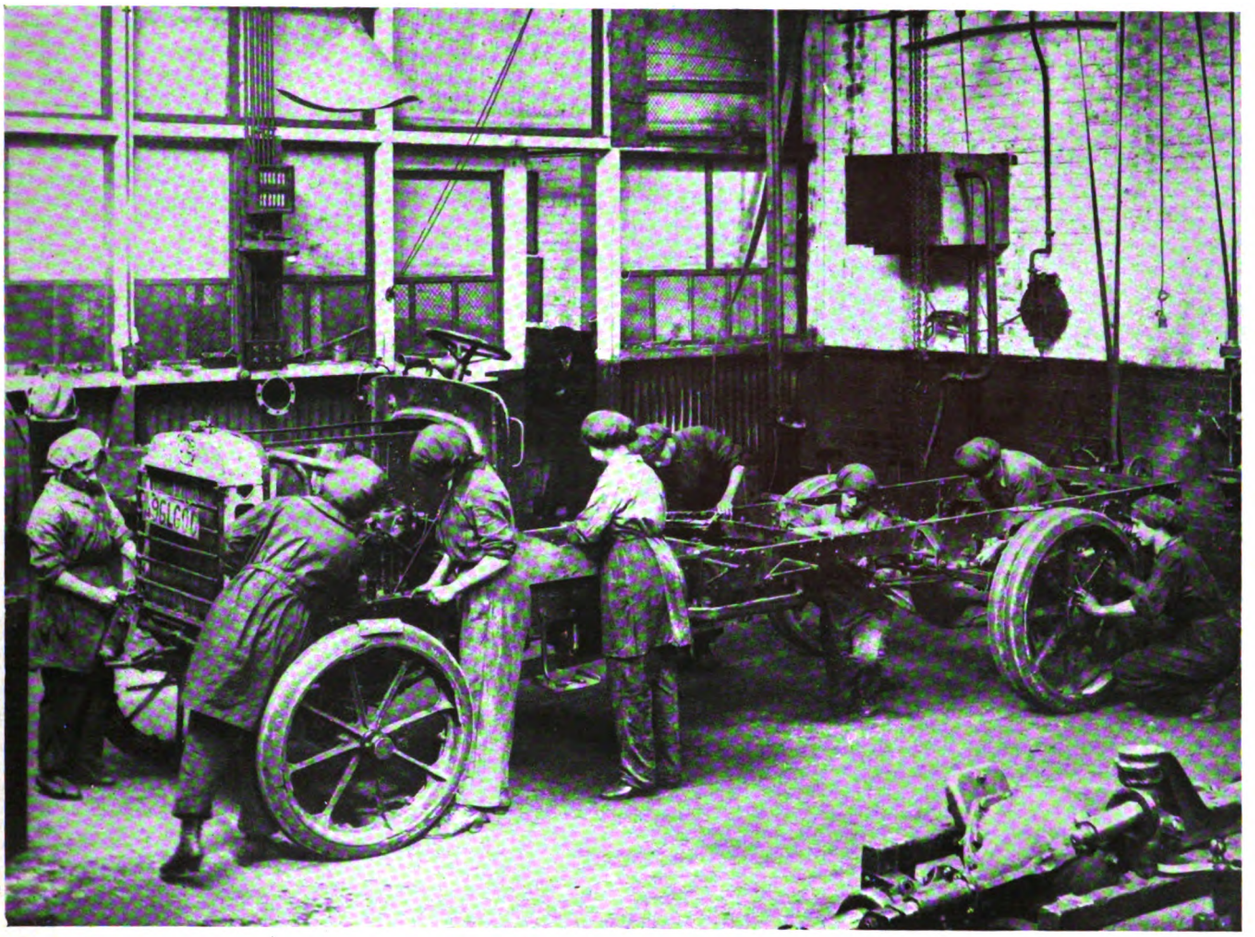
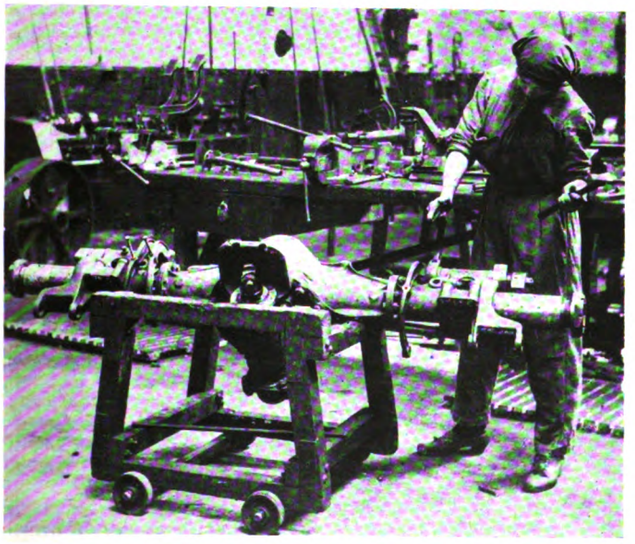
# MOTOR TRAFFIC.



Women Workers on Omnibus Chassis.



Women Workers at the London General Omnibus Company's Garages.

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# MOTOR TRAFFIC.

## SATISFIED USERS OF ELECTRIC VEHICLES.

REPLIES OBTAINED BY WEYMOUTH CORPORATION.

For two years the General Purposes Committee of Weymouth Council have been considering the question of obtaining petrol or steam motor wagons in order to cope with the labour and team shortage entailed by the war and the excessive cost of hire for the latter. Recently the committee have been gleaning information as to the working of battery vehicles, and with a view to induce the Corporation to sanction the purchase of one of these for trial they have made exhaustive inquiries from users, and obtained very satisfactory replies from South Shields, Ipswich, Newcastle, Wolverhampton, Birmingham, Pontypridd, Glasgow, West Ham, Leyton, Edinburgh, Dover, Accrington, Halifax, Carlisle, Ilford, and Chester. Dover has as many as six electric wagons in use.

A tabulated statement was submitted from six of the towns, and the committee reported that a great many municipalities and urban districts had vehicles on order, but under present conditions some time would elapse before delivery could be obtained.

The majority of towns use them for the collection of house refuse, and in all cases there is a saving shown per ton carted as compared with horse haulage. Each vehicle appears to be able to replace about three horses. Electrics require very little skilled labour in driving, and in Chester disabled soldiers are employed as drivers.

The type of vehicle recommended for purchase would cost £1,200, and the committee felt that this was not now strictly a matter for economy, although satisfied that the vehicle would prove more economical and satisfactory than horse haulage, but the fact remained that important work had to be left undone owing to scarcity of team labour, and that something must be done, whatever the cost, to keep the town in a cleanly and proper condition. Energy would be supplied by the Electricity Committee at about 1·2d. per unit, which compared favourably with the charge made in the various towns referred to. It would be necessary to expend £90 for installing a charging apparatus. The Corporation adopted the report, and an order will be placed.

IPSWICH'S PIONEER WORK FOR ELECTRICS.

Mr. Frank Ayton, electrical engineer and tramways manager to Ipswich Corporation, and hon. secretary to the Electric Vehicle Committee, in his own report on the Ipswich electricity undertaking, refers to a passage in his report for 1913 referring to the possibility of a new field opening for the use of energy, namely, the electric battery vehicle. "To-day," he continues, "there are five electrical commercial vehicles cared for in the garage opened by the department for the purpose, and four additional ones are expected shortly. The units sold for charging electric vehicles in the garage during the year totalled 13,160. The revenue, including garage charges, was £130. From a total of 150 old-fashioned and out-of-date electric vehicles, nearly all private cars, in use in this country in 1913, the number has grown, by the addition of the modern, and, as proved, highly successful type of commercial vehicle, to over 900. Ipswich was the first municipality in the country to establish a public electric vehicle garage; Glasgow, that most progressive city, followed a close second. There are now over 200 stations in the country where electric vehicles can be charged, and undoubtedly, so soon as the war ends, a great development will take place in this class of automobile for urban work. Before the war the modern type of electric vehicle was not made in this country, being imported from Germany and America. It should be a source of satisfaction to the town that the first British firm to undertake the complete manufacture of the modern type would be one located in Ipswich."

A YEAR'S WORKING AT SHEFFIELD.

In the annual report of the Health Committee of Sheffield Corporation it is stated that during the year ended March 31 last, three additional battery-propelled wagons were placed in service, and orders were given for five more. Further experience with these vehicles has confirmed the favourable opinions expressed in 1915–16 as to their value in refuse collection; in fact, had it not been for their use, the work of the department must have become hopelessly in arrears. The results of the year's working show conclusively that the work can be done more effectively, economically, and with less workmen than by horses. In comparison with the average cost by horse labour over the whole city, the electrics show a saving on bin refuse collection of 8·8d. per ton, and on ashpit refuse of 1s. 7·2d. per ton.

FREEDOM FROM ACCIDENTS COMPETITION.—Encouragement is being given by the borough surveyor of Marylebone to the Corporation workmen entering the Freedom from Accident Competition instituted by the London Safety First Council. The object is to lessen the number of street accidents due to any negligence on the part of drivers of public vehicles.

## EXHIBITION OF MOTOR VEHICLES WORKED BY GAS.

A USEFUL SHOW AT THORNYCROFT'S LONDON DEPOT.

It was in the early part of last year, when import difficulties coupled with the rapidly-increasing demands by the Services caused such restrictions to be imposed on the use of petrol that the first steps were taken to experiment with gas for motor vehicles. Many difficulties had to be overcome, but largely owing to the advocacy of the *Commercial Motor* and the *Motor* these were surmounted. Conclusive proof of the success of the innovation was seen at the demonstration of various types of vehicles, all using gas as fuel, which was held on October 10 at Messrs. J. I. Thornycroft's garage, Pulford Street, Westminster.

The demonstration was organised by the journals already named, and its outstanding feature was the great variety of vehicles among the 43 machines exhibited. These ranged from a cycle fitted with a flexible container with 40 cubic feet capacity, to an omnibus seating 40 passengers and fitted with a flexible container holding 800 cubic feet, built and loaned by the Bristol Tramways and Carriage Company. While the majority of the vehicles were of the parcel delivery type, with engines not exceeding 20 H.P., there were a few exceptions which demonstrated the fact that gas can be universally used. Amongst these were a 40-H.P. Thornycroft char-a-bancs equipped to run 18 miles on one charge, a 3-ton Austin market wagon, a 3½-ton Napier covered van, a 3½-ton Wolseley, and two 2-ton Thornycroft lorries. These machines are in regular service, working entirely on gas, and judging from the ease with which each vehicle negotiated the steep gradient from the ground floor of Thornycroft's repair garage to the street, it was evident that ample power was available, although it is generally considered that coal gas is 15 per cent. below petrol in efficiency.

## ENROLMENT OF MOTOR VEHICLES.

A CONDITION IMPOSED FOR THE RENEWAL OF FUEL LICENCES.

A reprieve has been granted to motorists, who by an order which was brought into operation on November 1 would not have been allowed to use petrol for any purpose which cannot be justified on the ground of absolute necessity.

The Board of Trade makes the following announcement regarding the endorsement on the demand note forms recently circulated by the Petrol Control Department for the renewal of motor spirit licences (for motor cars) after the end of October:—

> The issue of a licence will be subject to the condition that the licencee shall hold himself or his paid driver, and his motor car or cars, at the disposal of the military authorities for use in the event of a national emergency.

The particular "emergency" contemplated by this endorsement is that which would be caused by the invasion, or apprehended invasion, by an enemy force. In such an event the immediate supply of motor vehicles in districts affected would be of great military value.

The War Office propose to direct the county commandants of counties to ascertain the number of motor vehicles thus available in a county through the Motor Volunteer Corps organisation. The object to be aimed at is the enrolment of sufficient motor vehicles to meet all military needs caused by such a contingency as invasion.

## BRISTOL TRAMWAY COMPANY'S GAS OMNIBUS.

The two photographs reproduced on page 349 illustrate the Bristol Tramways and Carriage Company's motor omnibus running on coal gas, which was shown at the recent exhibition in London. The capacity of the bag is 850 cubic feet, a sufficient quantity to drive the omnibus 19½ miles on a hilly route. The average time taken to fill the bag from a 3-in. stand pipe is five and a half minutes. The connecting valve for filling purposes is the company's own design and is said to work extremely well. The total weight of the superstructure and bag is from five to six hundredweight, according to the thickness and quality of the material used. A deep vertical tray carried well forward over the canopy prevents any sagging of the container over the side when partially deflated. There is a very slight loss of power, but not sufficient to diminish the efficiency of the omnibus, which carries 40 passengers.

PETROL ALLOWANCE FOR ESSENTIAL TRADES.—The President of the Board of Trade, in reply to a question in the House of Commons on October 30, said that the allowance of petrol to be granted for use in commercial vans and lorries is under consideration, and the quantities allotted will be confined to the minimum necessary for essential trade.

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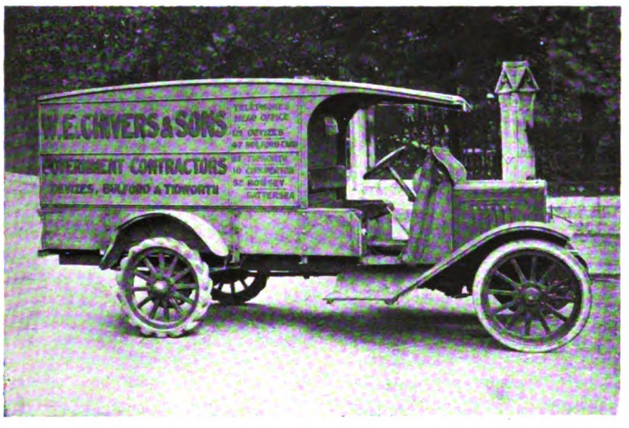
# MOTOR TRAFFIC.

## THE MACINTOSH AND SHREWSBURY NEW SOLID TIRE AND WHEEL WORKS.

As a consequence of the combination of the solid tire works previously carried on by Chas. Macintosh and Company, Limited, and the Shrewsbury S.T. and Challiner Tyre Company at Page Street, Westminster, and the wheel works of the latter company at Camberwell, extensive premises, well suited to the purpose, have been secured by the above-named companies at the corner of Wilton Road and Gillingham Street, S.W. (near Victoria Station), where the most up-to-date service, both with regard to tires and wheels, will at all times be available. Although, owing to the war, it has not been possible to carry out the company's building plans in their entirety, the essential buildings for efficiently carrying on the work have been completed, and on Thursday, October 25, at the invitation of the directors of the companies, a number of Press representatives inspected the premises and the various processes, both in the wheel building and tire fitting departments.

The new premises, which have a ground floor area of 21,000 square feet and 7,500 feet on the upper floors, being easy of access by road and adjacent to three important railways, are well placed to render that prompt attention to repairs and renewals which is so essential to the economic working of motor transport. In addition to extensive loading and unloading platforms for the convenience of the receipt and dispatch of goods for the home and export markets, the ground floor premises include large and lofty garage space,



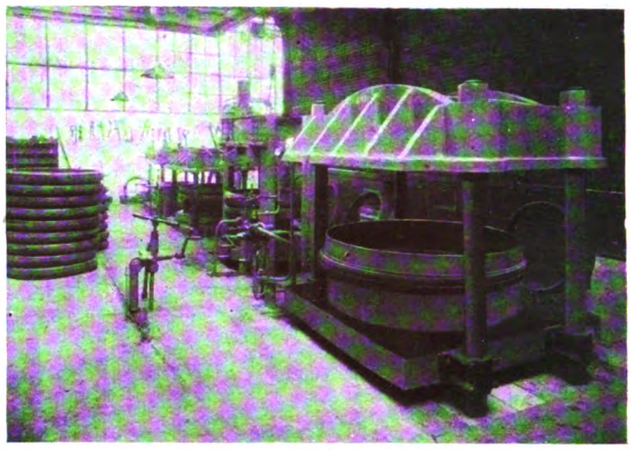

Van with Challiner Cross-Ribbed Tires on Rear Wheels.

where vehicles can be re-wheeled or re-tired with the greatest possible convenience and dispatch. The engineering shops are replete with a range of hydraulic presses of various sizes, including one specially designed for tractor engine wheels fitted with rubber tires up to 5 feet in diameter, plate bending rollers, lathes, welding plant, tire furnaces, and all the latest appliances necessary for a thoroughly up-to-date plant.

A large solid tire store also occupies part of the ground floor space. Here an extensive range of tires of all sizes in general use is held in stock, this being maintained by the regular service of 3-ton Leyland vans running constantly between the stores and the works in Manchester. The pneumatic tire department adjoins the solid tire store, with showroom facing Gillingham Street, and conducts a large business in the sale of tires, tubes, detachable rims, etc.

In addition to the ordinary solid rubber band tires manufactured by Messrs. Chas. Macintosh in every conceivable size and section to meet all requirements of motor traction, the company have displayed great enterprise in producing tires for steam traction engines. They manufacture tires for this class of work in various sizes and sections from 120 mm. to 160 mm., with diameters ranging up to 5 feet, and in order to cope with the great increase of business with this class of tire they have here installed a tire press, which is capable of fitting these large diameter tires in one operation. As the owners of tractors have now recognised the advantage of rubber tires, and the company are fully equipped for orders in every respect for this description of tiring, they anticipate that a much larger volume of business will accrue.

The chief engineer to one of the company's principal tractor tire customers states that he finds now that he has gone over to rubber tires that the tractors give better tractive effort, less shock on starting, and triple the life of the wheels; they also enable them to obtain double life of their axle bearings, less, if any, broken axles, no side-slip or revolving wheels, and they prove ideal for snowy roads. They give triple life to tender bolts, where holes get elongated and have to be renewed after a few months' work. He further states that they get no broken canopy sets or fixing bolts, and an increased speed, less vibration and shock on all roads, with better conformity

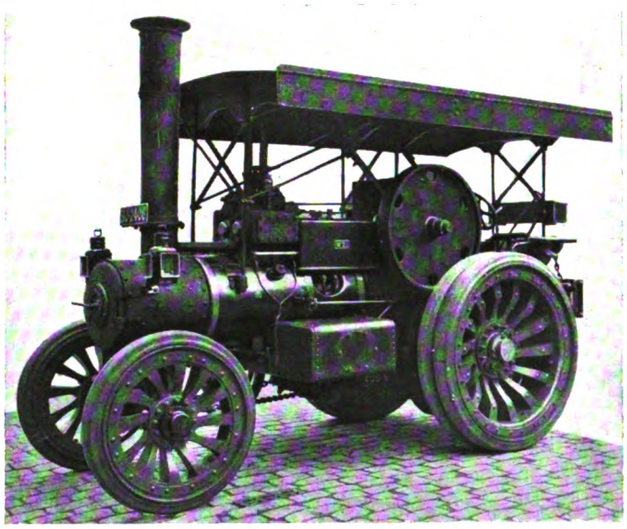


Hydraulic Presses—On the Right, Tractor Tire Press.

of tread of tires to comply with the road surface. Further, the life of tractor wheels seldom reaches two years with steel tires, the spokes and the channels strip and crack, and they require re-treading about every 7,000 miles; also tightening up, and the channels want turning down every 2,000 miles. He finds that rubber tires overcome all these defects. The driving of a tractor is very shaky work for the man at the wheel, and here again the rubber tires eradicate trouble.

The life of rubber tires fitted to steam tractors is of great importance, and it is interesting to note that the company have recently re-tired the first set of wheels of 120 mm. section after the original set had completed nearly six years' regular service.

The cross-ribbed tire is a type generally fitted by the company to light delivery vans in place of the ordinary single band tires fitted to the driving wheels, and has proved an excellent non-skid tire. It is also adopted for the important work of fire engines. Recently a set of Challiner cross rib tires, fitted to a fire engine, accomplished a non-stop run of 60 miles at top speed on the occasion of an



Tractor with Macintosh Solid Band Tires.

explosion, and with complete satisfaction, enabling the fire engine to come into operation in record time.

The Macintosh and Shrewsbury and Challiner tires have been adopted by the British, Foreign and Colonial Government departments, also municipalities, motor omnibus and railway companies, and many of the prominent business houses throughout the country.

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# MOTOR TRAFFIC.

We give two illustrations of the type of vehicle fitted with tractor and cross-ribbed tires, and a view of the hydraulic presses with the tractor tire press in the foreground.

The wheel department was founded at Camberwell in 1900, to meet the requirements of the rubber tire users of that day. With the advent of the motor vehicle the department became more important, chassis builders submitted their designs, and in a very short period the department grew to be one of the leading centres of motor wheel building. No expense has been spared in putting down machines of every type to meet the advances in motor wheel construction.

Almost from the commencement of the war the department (now "controlled" by the Government) has been fully employed on wheel building for the Ministry and war service vehicles. Particularly interesting are the Challiner twin detachable rim wheels, now being turned out in large quantities for Red Cross ambulances and other war service vehicles. The Camberwell premises were taken over by the Government in June last, and a severe task was given the department to put down plant at short notice in the new premises, and to keep up the weekly deliveries of their war service contracts. The difficulty was, however, overcome.

The workshops are set out in model fashion, capable of undertaking the building of motor wheels of every description, and the output still goes on and on, showing what can be done by a firm intent on doing their utmost to advance and maintain the prestige of British manufacturers.

## STEAM WAGON WORKING COSTS.

Included in the report of Mr. J. C. Haller, county surveyor of Nottinghamshire, for 1916-17, is the appended table of the cost and working of two steam wagons :—

| | Burrell. | Clayton and Shuttleworth. |
|---|---|---|
| Date purchased ... ... ... ... | Nov., 1915 | July, 1916 |
| Cost with two trailers ... ... ... | £800 | £850 |
| Working period, up to March 31, 1917 | 12 months | 8 months |
| Working costs :— | £ s. d. | £ s. d. |
| Wages ... ... ... ... | 144 7 9 | 123 0 8 |
| Coal ... ... ... ... ... | 80 4 1 | 60 9 0 |
| Oil ... ... ... ... ... | 8 16 9 | 6 0 10 |
| Repairs, tires, etc. ... ... ... | 103 10 9 | 33 7 2 |
| | £336 19 4 | £222 17 8 |
| Add depreciation at 12½ per cent. ... | 100 0 0 | 70 16 8 |
| | £436 19 4 | £293 14 4 |
| No. of days worked ... ... ... | 257 | 207 |
| ,, loads hauled ... ... ... | 847 | 744 |
| ,, tons carried ... ... ... | 7,513 | 6,602 |
| ,, miles travelled ... ... | 5,080 | 3,357 |
| ,, miles travelled loaded ... ... | 2,540 | 1,678 |
| ,, tons hauled per journey ... | 8·87 | 8·86 |
| Cost per day ... ... ... ... | £1 14 0 | £1 8 4½ |
| ,, mile ... ... ... ... | 3s. 5¼d. | 3s. 6d. |
| ,, ton per mile ... ... ... | 4·65d. | 4·75d. |

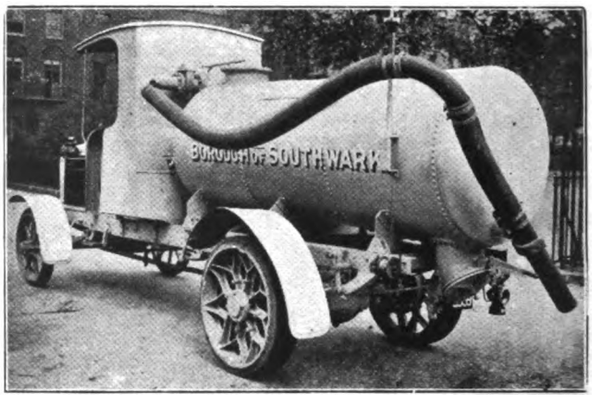
At 4¾d. per ton-mile the cost of haulage comes out below the estimate of 5d., and despite of the increased cost of wages and materials Mr. Haller is of opinion that the work will continue to be carried out within the rate mentioned. It would have been impossible, he adds, to have carried out the work dealt with in his report if he had been without wagons. An order for a third steam wagon and trailers was placed some time ago, but owing to the demands of the army for wagons of this type some months are expected to elapse before delivery.

German Motor Works Producing Aircraft.—Of late the German motor manufactories have been producing aircraft on an increasing scale. The Daimler Company, of Haustatt-Stuttgart, have increased their capital from £1,200,000 to £1,600,000, and the Imperial Bank have aided the flotation of the new shares. In a circular the company state that they can no longer expand their works, but must build new factories. "An additional purpose," the company state, is "to strengthen their resources for the duties which industry will have to perform after the war."

## STRAKER MACHINES FOR MARYLEBONE COUNCIL.

The Marylebone Borough Council has for some time past had under consideration suggestions for the improvement of its system of street cleansing, and at the last meeting of the Council it was decided to adopt the recommendation of the Highways Committee whereby the whole of this work was carried out by its own employees by means of special street cleansing machines, to be purchased from Messrs. Straker-Squire, Blackfriars, London, S.E.

From the report which the Highways Committee have prepared it was shown that the work of emptying and cleansing the street gullies has hitherto been carried out by contractors, who supplied




"Straker" Vacuum Gulley Cleaner.

four slop vans, horses and drivers at a cost of £4 per day, supplemented by two water vans, horses and drivers and four gulley men provided by the Council at a cost of £3 6s. per day, a total cost of £7 6s. per day. With a view to effecting an economy, as well as having the work carried out under more hygienic conditions, the committee recently inspected the Straker-Squire vacuum gully cleaner and high pressure street washer, which have been used so satisfactorily by the Southwark Borough Council for the past two years. From the records obtained from the Southwark borough surveyor of the work done by the gully cleaner, it was estimated that the whole of the street gullies in St. Marylebone could be efficiently dealt with by the use of one machine at a cost of £4 8s. per day, thus showing a saving of £2 18s. per day. The cost of this machine, an illustration of which is given above, is £950, so that the annual saving effected by its use is almost equal to its full cost. The

"Straker" High-Pressure Street Washer.

capacity of the tank or container is 800 gallons, and on an average 50 gullies per day can be cleared. The chassis is the Straker-Squire standard 5-ton machine.

In recommending the purchase of the Straker-Squire high pressure street washer, which is shown in the second illustration, the committee recalls the fact that it had been unable to obtain delivery of a "Laffly" motor road sweeper, owing to the French Government having commandeered the output of the Laffly works. It is of the opinion, however, that a much more efficient machine has now been discovered in the Straker-Squire road washer, which has been tested with most satisfactory results.

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# MOTOR TRAFFIC.

The cost of the Straker-Squire road washer is £950. It is fitted with a tank capable of holding 1,100 gallons of water, which is sprayed on to the road surface through two spherical nozzles, fitted in front of the chassis, under a pressure varying between 36 and 60 lbs. per square inch by means of a centrifugal pump driven by the engine. The high pressure water, which is directed at an angle of 45 degrees, loosens the dirt, and the road surface is then cleansed by means of rubber squeegees fixed under the chassis about midway between the two axles. In order to be adaptable to the inequalities of the road surface the squeegees are made in three sections and mounted upon a hinged framework. It is claimed that from 20 to 25 miles of roadway can be washed per day, while in dry weather the machine can also be used for ordinary street watering.

## MOTOR VEHICLES FOR MUNICIPALITIES.

STALYBRIDGE COUNCIL propose to obtain a motor fire engine.

ROTHWELL COUNCIL have ordered a 3-ton lorry, at a cost of £731.

NEWCASTLE CORPORATION have purchased a first-aid motor car.

THORNABY COUNCIL contemplate the purchase of a motor fire engine.

BATH COUNCIL have placed an order for a 5-ton Sentinel steam wagon with Messrs. Alley and Maclellan, Limited, at £970.

**A Portion of a Recent Convoy of 2-3 Ton Austin Lorries.**

Several of these vehicles on leaving the works at Northfield, made very successful journeys to Glasgow.

BOLTON GAS COMMITTEE have received two tenders for the supply of a motor wagon.

ESSEX COUNTY COUNCIL have sanctioned the purchase of steam lorries at a cost not exceeding £1,000.

LEEDS CORPORATION have sanctioned the provision of a workshop at the fire brigade station for the repair of motor vehicles, the cost not to exceed £300.

CALCUTTA MUNICIPAL COUNCIL having proved the economy of motor vehicles for street cleansing work have decided to obtain two additional wagons.

SALFORD COUNCIL have placed an order with a local firm for the supply of a 2-3 ton 20-H.P. Austin chassis, with tipping body, steel-lined, and accessories for £764.

HALIFAX CORPORATION have cancelled the order given to Messrs. Alley and Maclellan, of Shrewsbury, for two Sentinel steam wagons, at £740 each, the firm finding it impossible to guarantee delivery within the period required.

SOUTHEND CORPORATION have obtained a "B" priority certificate in lieu of the "C" certificate originally allowed by the Ministry of Munitions for four battery vehicles ordered from Messrs. Ransome, Sims, and Jefferies, of Ipswich.

NORWICH CITY COUNCIL have adopted a scheme of refuse collection and disposal, which includes the purchase of five 4-ton battery wagons at £1,200 each. It is estimated that 27,000 tons will require to be transported yearly an average of 2½ miles, i.e., five miles for the double journey, at 3½d. per ton per mile of the double journey.

BIRMINGHAM HIGHWAYS DEPARTMENT, according to the report of Mr. H. E. Stilgoe, the city engineer, for 1916-17, require additional motor appliances owing to the shortage of labour and the change of conditions under which work will have to be carried on. Four steam wagons and three tractors, with nine trailers, already in service, have been of great service. Two petrol-driven street sweepers have been purchased, another has been built in the Corporation shops on the chassis of a disused car, and a fourth is in hand. Inquiry has been made for others, but makers find it impossible to promise delivery, owing to pressure of war work. A combined sweeper with elevator for automatically loading the sweepings into a wagon was obtained during the year, and Mr. Stilgoe states that this type of machine will be of great assistance. A similar machine is about to be delivered.

## MOTOR WAGONS TO RELIEVE RAILWAYS.

In connection with the scheme initiated by the Ministry of Munitions for the use of commercial motor vehicles in order to relieve the pressure on the railways, the Sheffield and Manchester Chambers of Commerce have started a service between those cities. For some years past motor vehicles have been used to a great extent in the cotton traffic between Manchester, Liverpool, and other Lancashire towns, and during the past year the Manchester Chamber of Commerce has inaugurated a return load organisation for the purpose of extending this traffic.

For some months the Leeds district office of the Ministry of Munitions has been engaged in encouraging motor transport between various places in Yorkshire and the adjoining counties. In a communication from the Leeds office which was recently received by the Ossett Chamber of Commerce it was stated that if there was a shortage of privately-owned wagons for short distance traffic the question of providing Government vehicles would have to be considered. In the course of the discussion on the Leeds letter, a member stated that his firm had to send goods by rail which could be delivered by their motor wagons if they could obtain a sufficient allowance of petrol. Although the firm could not obtain petrol, yet they could hire motors for the work. Another member remarked that if return loads could be obtained for other people it would be a great benefit to local trade. The Chamber decided to point out to the Ministry of Munitions that at present full use could not be made of motor vehicles on account of the unequal and insufficient petrol supply.

## INSTITUTION OF AUTOMOBILE ENGINEERS.

The second ordinary meeting of the Institution of Automobile Engineers was held in the Physics Lecture Room, University College, Gower Street, W., on November 14, when Dr. E. G. Coker read a paper entitled "Photo Elasticity for Engineers." Dr. Coker dealt with further important researches which he has been making on the demonstration of stresses by means of the polariscope, and for this purpose the principal illustrations were shown by means of lantern slides.

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# MOTOR TRAFFIC.

## COMMERCIAL VEHICLES IN NATIONAL SERVICE.

NOTES ON AN ADDRESS BY FIELD-MARSHALL VISCOUNT FRENCH.

In speaking at a meeting held on November 7, and organised by the London Chamber of Commerce in conjunction with the City of London Motor Transport Volunteers, Lord French stated that, without adequate motor transport, the whole existing volunteer organisation would be rendered completely useless for its main purpose; that is to say, for assisting the regular army in the event of invasion. Should any such contingency arise—and Lord French clearly does not regard it as impossible—the various units of the Volunteer force would have to be concentrated at the points selected for that purpose, in the course of a very few hours. This could only be done by utilising large numbers of motor vehicles, which must necessarily be enrolled and organised in advance. The next step would be the conveyance of the Volunteers and their impedimenta to the point or points threatened. This, again, would have to be accomplished with the greatest possible despatch, and motors are quite essential for this purpose also. In short, the whole real utility of a Volunteer Force for home defence is conditional on extreme mobility which, lacking ample motor transport, would be quite unattainable.

Motor drivers, enrolling with their vehicles, do not require any considerable technical training. They are already fully competent to carry out their most important duties. A few drills are, however, necessary, and also a certain amount of map reading. It is intended to bring down formal drills to an irreducible minimum, as it is recognised that the men, already having arduous civilian duties to perform, cannot be asked to give very much time to such additional work. Efforts are also being made to arrive at some satisfactory understanding as to the compensation which would be paid in the event of injury to the driver or damage to his vehicle while on military service in time of emergency.

As to the classes of machine required, it would appear that the principal requirement is for substantial industrial vehicles, whether propelled by steam or by petrol. In some districts, but not in all, light cars may also be utilised. This depends on the local relation between supply and demand. At present, the total demand is not yet exactly known, but steps are being taken to estimate it promptly. In the meanwhile, we have the assurance of Lord French that all the available vehicles would not be too many, and interest is evinced in the possibility of putting on the road again the considerable number of machines that are now out of commission for comparatively trifling causes, such as the lack of small replacements or of repairing facilities.

It should be understood that while service in national emergency is the first and foremost requirement which the motor volunteer agrees to fill, he may, if he be willing, enrol also for another class of service, of a less absolutely essential, but nevertheless very important kind. The County of London Motor Volunteers have, in this secondary type of service, actually covered over one million miles since their first formation, and fully 100,000 miles during the last three months. Their work has been varied. It has consisted partly of the conveyance of staff officers, and, on occasions, of German prisoners; the evacuation of hospitals; and particularly of meeting at London stations men returned from the front on short leave, and conveying them to other termini or to their destination, according to circumstances. This is admirably useful work of its kind and, as Lord French tells us, has a special value in its indication to the troops, and particularly to those who hail from the oversea Dominions, that their friends at home are ready and anxious to do everything possible for them.

The case in favour of supporting the Motor Volunteer movement is altogether a very strong one, even if we do not take into account the fact that nowadays every petrol licence is granted subject to the provision that the licensee places the services of his car and of himself or his driver at the disposal of the Government in the event of national emergency. This being so, it would seem best to do the thing with a good grace, and in that case enrolment in the volunteers is the obvious and proper course. The meeting to which this note refers acknowledged the principle in a resolution, carried unanimously, to the effect, "This meeting of owners and users of commercial motor vehicles fully recognises the need for enrolment through the Motor Transport Volunteers and recommends the movement to all concerned."

HOURS OF MOONLIGHT.—Messrs. C. A. Vandervell and Company, Limited, have issued a picture postcard in black and white, giving a useful moonlight chart, from which the hours of moonlight can be seen at a glance. The chart was compiled by Mr. A. H. Midgley, their chief engineer.

## MOTOR TRAFFIC NOTES.

FOOTPATH SEAT FOR OMNIBUS PASSENGERS.—Kensington Borough Council have agreed that a seat should be placed on the pavement at the corner of Kensington Road and Palace Gate for the convenience of passengers who have to wait considerable periods for motor omnibuses. The Council have asked the Metropolitan Public Gardens Association to provide the seat.

LONDON AMBULANCE SERVICE.—The number of calls for the last three years on the London County Council motor ambulance service have been:—1915, 2,405; 1916, 9,244; 1917 (to October 21), 10,014. Commander Sladen, R.N., chief officer of the fire brigade, and Dr. Mugliston have organised the service with great efficiency. During the recent raids it promptly removed the sufferers to hospitals.

OMNIBUSES AND NEW ROUTES.—For several months Ilford Urban Council have been in communication with the London General Omnibus Company in reference to the alleged use of new routes, contrary to the Emergency Act, 1916. The Council have now decided to adjourn for the present the question of taking legal proceedings. By the company it has been contended that the route used is not a new one.

U.S.A. GIFT OF LORRIES TO LONDON.—The Motor Transport Volunteers, who provide the official transport of leave troops from the various London stations during the night, have received gifts of motor lorries from America, thanks to the propaganda in the United States of Lady Lister Kaye, wife of Sir John Lister Kaye, who, with Commandant C. R. Freemantle, founded the corps in February, 1916. Lorries have been presented by New York City, Newport, Rhode Island, the State of California, and one by Lieut. J. Cromwell, Philadelphia.

CHARGING OF ELECTRIC DELIVERY VANS.—John Barker and Company, of Kensington, have applied to the Borough Council for consent to be given to the retention of four iron brackets fixed to the wall of their premises, and overhanging the public footway. The brackets are used to support cables in connection with the charging of the company's electric vehicles, the arrangement being a temporary one. Provided that the cables are adjusted so as not to interfere with pedestrian and vehicular traffic, the Borough Council have recommended that the County Council should permit the brackets to be retained until the termination of the war and for six months after.

A JUDGE'S AID TO PETROL ECONOMY.—Mr. Justice Eve was recently trying an action in the Chancery Division when he decided that the proceedings would be shortened if he inspected the premises at Tottenham which were concerned. Upon counsel suggesting that a cab should be hired, the judge refused to be a party to the waste of petrol, and said he could journey comfortably by train from Liverpool Street to Bruce Grove. A shorter journey from the court would have been by tramcar from Holborn. It is encouraging to find that there is one highly-placed personage who is awake to the need for petrol economy, and it would be advantageous to the country if the majority of the motor-cab drivers—a dissatisfied class—could be put on to driving industrial vehicles. Adequate facilities for passenger transport in London are provided by the railway, tramway, and omnibus services.

## REAR WHEEL GUARDS TO NEW YORK OMNIBUSES.

The Fifth Avenue Coach Company, New York City, have adopted a rear wheel guard similar to that of the London General Omnibus Company. *The Electric Railway Journal* (New York) states that the fenders are "located on either side of the 'buses, between the front and rear wheels, and curve outward toward the rear, so that rear wheels of each vehicle are thoroughly protected. Oddly enough, the majority of accidents to pedestrians in the streets of both New York and London on account of the motor omnibus have been rear wheel accidents. In New York all classes of omnibus accidents are surprisingly few, the record last year being on the basis of one pedestrian injured to more than 1,500,000 miles of service. This excellent showing is largely due to the fact that the company is exceedingly careful in the selection and training of its chauffeurs, so that avoidable accidents to pedestrians have been almost wholly eliminated. With the installation of the fenders it is believed that mishaps to persons in the streets will be practically a thing of the past. These fenders, it may be said, were provided on the company's own initiative, its safety record having been such that its equipment has never been unfavourably criticised by the public authorities."

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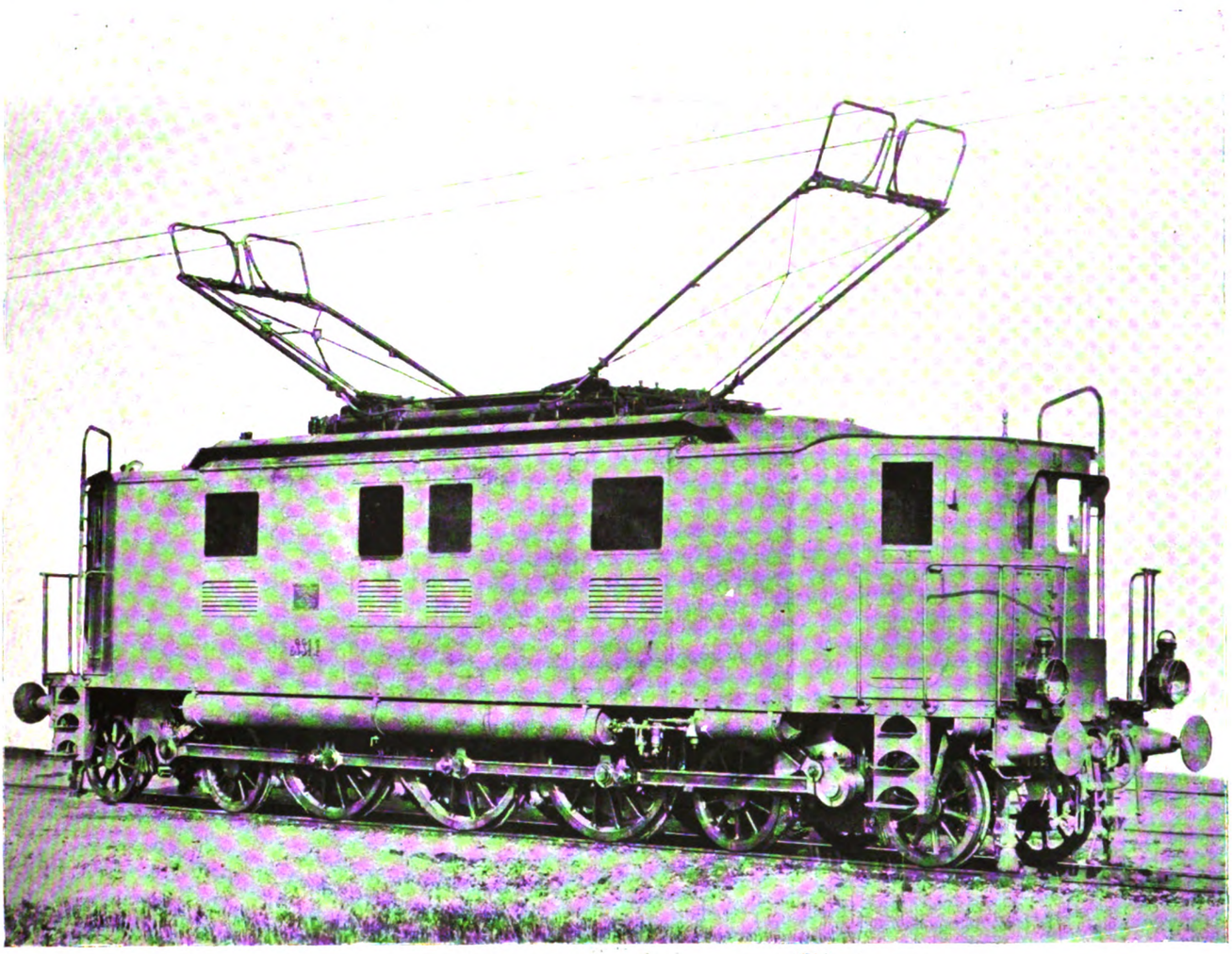
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, DECEMBER 13, 1917. VOL. XLII.

# ELECTRIC LOCOMOTIVE FOR ITALIAN STATE RAILWAYS.

The Italian State Railways have in service the first of a new series of three-phase electric locomotives ordered from the Brown Boveri Company, of Italy, for use more especially in high-speed services on fairly level routes where the curves are sharp and frequent.



Three-Phase Electric Locomotive—2-C-2 Type—Italian State Railways.

Locomotives of somewhat similar type were referred to in our issue of August 10, 1916, and some of the details of designs were then given. We now take the opportunity of publishing a more complete description with drawings and photographs, in order to show the novel features of a more recent type especially designed for these particular conditions. For this information and the illustrations we are largely indebted to the *Rivista Tecnica* of the Italian State Railway service, which has published a useful account of the locomotives, prepared by Sign. P. Verole and B. Marsili, of the State Railways department.

The general working conditions and the essential features of the new locomotives correspond so far as regards the tractive force, speeds, and efficiency with those obtained with the polyphase locomotives previously built for the State Railways by the Italian Westinghouse Company and described in our issue above mentioned, under the heading of type 1-C-1; the type now introduced is known as 2-C-2. Italian engineers, it should be noticed, describe locomotives

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by the axles and not the wheels; in English parlance, these would be respectively of the 2-6-2 and the 4-6-4 class.

Like the other powerful electric locomotives already at work on the Italian railways, these new ones are provided with four running speeds, though obviously they could be much simplified by employing two speeds only. The difficulties of working with two speeds are, however, greater than the advantages of locomotive simplification. If the maximum speed is to be not less than 100 kilometers per hour (62 miles) whatever may be chosen for the lower speed, it would not be possible on existing lines, or those to be electrified, to satisfy the requirements of train circulation. An intermediate and also a low speed will both be necessary if time is not to be lost on certain parts of the line.

Moreover, for coupling up two locomotives to a heavy train, a multiple control can only be secured by the locomotives being of similar speed design; and for starting, it is clear that excessive waste of current must occur in resistances unless a comparatively low starting speed is provided. Hence the four running speeds of the new design give a much wider range of economical working although at the cost of some complications in the electrical and mechanical arrangements of the locomotive.

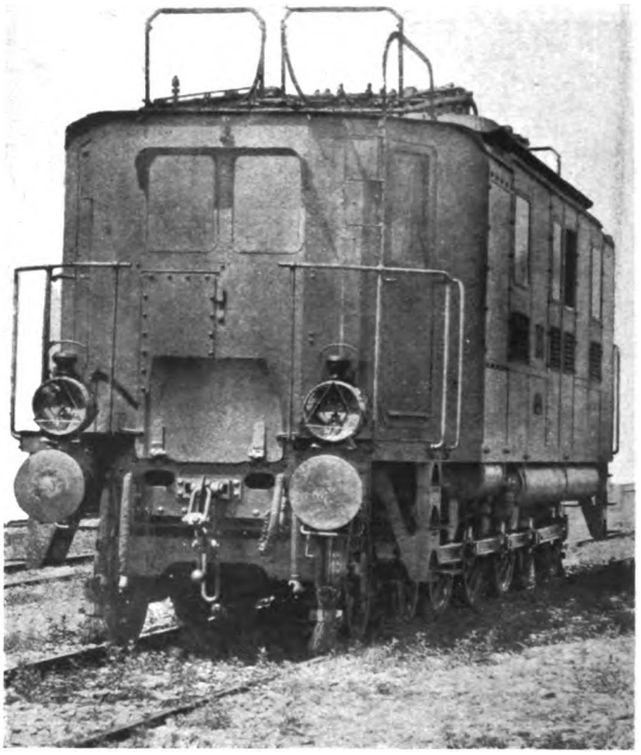
The main features of the locomotive are shown in the following summary:—

Line contact pressure, 3,000 to 3,700 volts, alternating.
Frequency, 15 to 17 periods.
Number of motors, 2.
Total weight, 92 tons; adhesion weight, 49·5 tons.
Coupled driving axles, 3.
Running axles, 4, on two swivelling bogie trucks, front and rear.
Diameter of driving wheels, 5 ft. 3¼ in.
Diameter of running wheels, 3 ft. 1½ in.
Running speeds (motors in synchronism) at frequency of 16·7 periods, allowing for half wear of tires:—
100, 75, 50, and 37·5 kilometres per hour.
Equal to 62, 46, 31, and 23 miles per hour.
Tractive force at driving wheel periphery, continuously for one hour, frequency 16·7 periods, line pressure 3,300 volts, respectively in tons:—
Miles per hour, 62, 46, 31, 23.
Tons ... ... 6, 9·5, 9, 9.
Tractive force at driving wheel periphery, with adhesion co-efficient of quarter maximum obtained on sanded track, at starting, about 12 tons.
Efficiency and power factor of driving motors, with normal loads and at speeds of 62 and 46 miles per hour, respectively, 0·935 and 0·85.

Four-wheeled bogie trucks are provided at each end instead of the two-wheeled radial axles of the 1-C-1 type, in order to give greater ease of running on short radius curves at high speeds. This method does not, however, allow so much useful weight for adhesion purposes, the comparative figures being thus stated:—

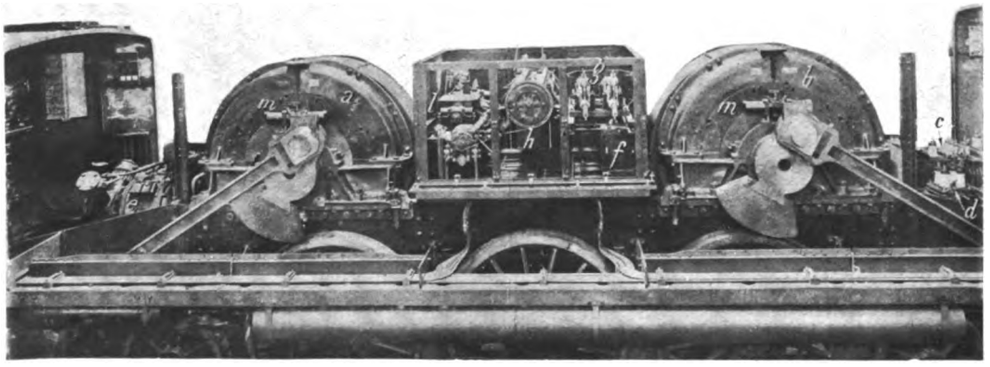
| | *Total weight.* | *Available for adhesion.* |
|---|---|---|
| 1-C-1 ... ... ... | 73 tons ... | ... 51 tons |
| 2-C-2 ... ... ... | 92 .. ... | ... 49·5 .. |

With a two-wheeled axle at each end, the 2-C-2 type should presumably have about 64·3 tons available for adhesion; but so long as the loads are not excessive, and this is not to be expected in high speed services, the advantages of easy travel round curves is preferred to surplus adhesion weight. In any case the tractive efforts are the same for the different speeds.



**Front End View of Three-Phase Electric Locomotive.**

The six coupled driving wheels have, of course, no lateral play, but the rigid wheel base is comparatively short — 11 ft. 0¾ in. with driving wheel centres half of this, or 5 ft. 10 in.; total length over all, including buffers, 44 ft. 6 in. The system of driving embodied in the mechanism between motor axles and driving wheels is the same as that already used in the 1-C-1 type where connecting rods from the motor axle crank discs are coupled to similar crank discs on secondary axles mounted



*a, b.* Traction motors
*c.* —Transformers.
*d.* Transformer switch.
*e.* Air compressors.
*f.* Insulated box for discharger.
*g.* —Knife switches.
*h.* —Resistance regulator.
*l.*— Locomotive reversing switch.
*m.* —Compressed air cylinders controlling rotor pole changer.

**Side View of Three-Phase Electric Locomotive, showing Traction Motors and Insulated Box Compartment for High Tension Gear.**

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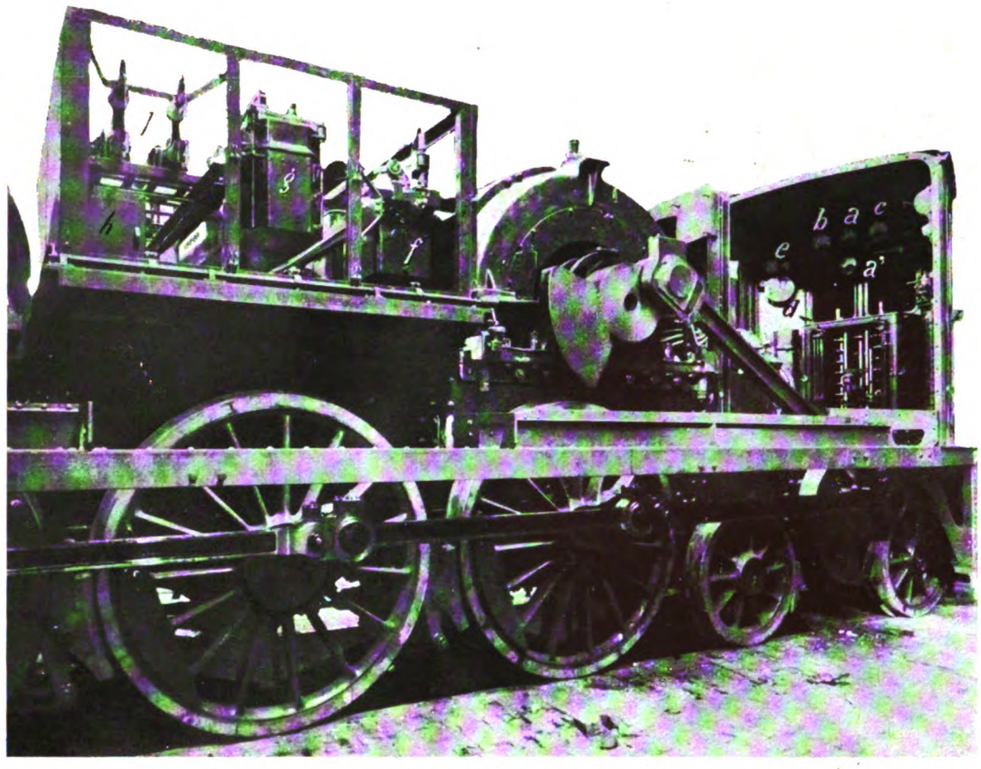
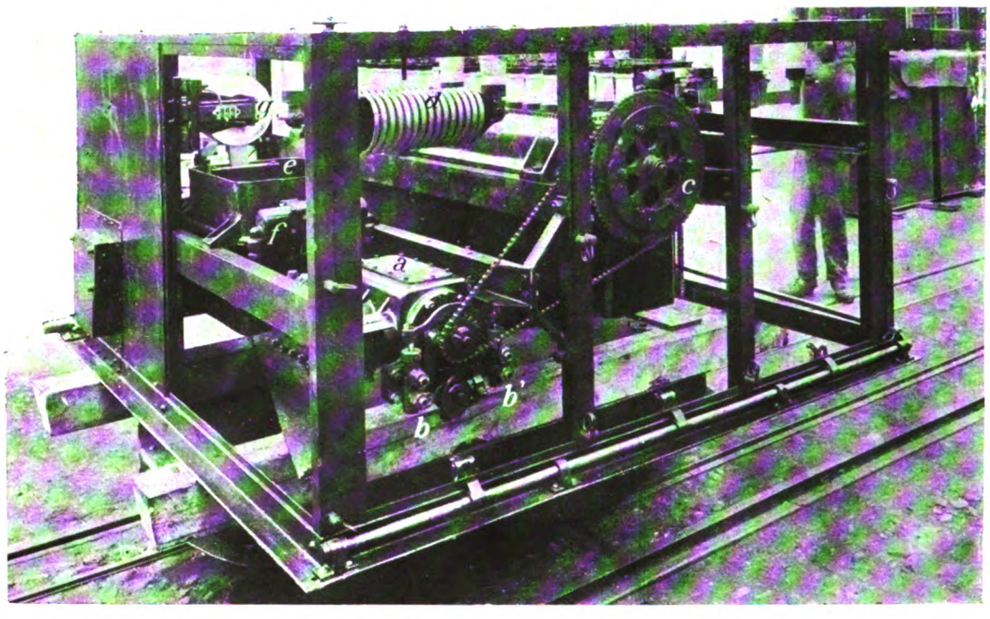



*a*, $a_1$.—Ammeters.
*b*.—Voltmeter.
*c*.—Wattmeter.
*d*.—Speed indicator.
*e*.—Pressure gauges.

*f*.—Automatic cut-out for traction motors.
*g*.—Resistance regulator.
*h*.—Insulated box for discharger.
*l*.—Knife switches

**Side View of Three-Phase Electric Locomotive, showing Connecting Rod Driving Gear.**




*a*.—Three-cylinder compressed air motor controlling resistance regulator.
*b*, *b*.—Air valves adjusting resistance regulator control with control lever on main controller.
*c*.—Resistance regulator.

*d*.—Impedance coils.
*e*.—Locomotive reversing switch.
*f*.—Compressed air cylinders controlling *e*.
*g*.—Transformers.

**Insulated Box Compartment for High-Tension Gear.**

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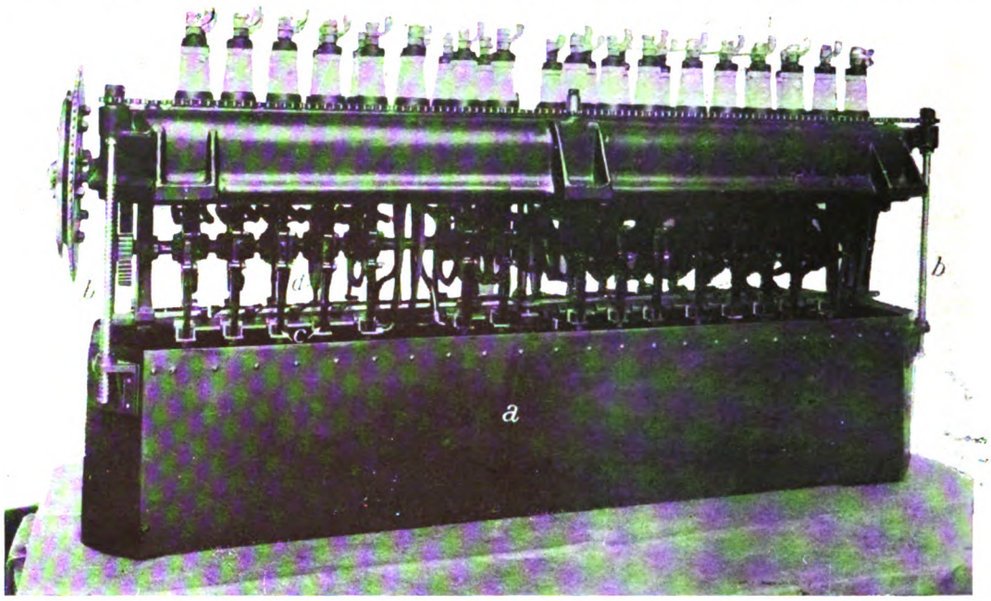
in the locomotive framing, and also provided with side rods connecting up all the driving wheels on each side. The working angle for the connecting rods, which on the smaller locomotives could not be reduced below 60 deg., has now in these larger and longer types been brought down to about 33 deg., and this flattening of the driving rods' angle must considerably reduce any vertical forces acting through the auxiliary axles.

Automatic compressed air brakes are fitted, and can be applied to all the locomotive wheels, there being a separate cylinder for each bogie truck, and one for the six coupled driving wheels. The braking force on the coupled axles, with average air pressure of 50 lbs. per square inch, represents about 60 per cent. of the adhesion weight, that on the truck axles is a smaller amount—about 35 per cent. A hand brake worked from either end of the locomotive acts on the coupled wheels only. The electrical details of these new locomotives will, however, prove of most interest to our readers, and we therefore give them at greater length.

The four running speeds already referred to are, as usual, obtained by connecting the motors either in series or in parallel, and by corresponding variations in the number of poles, thus :—

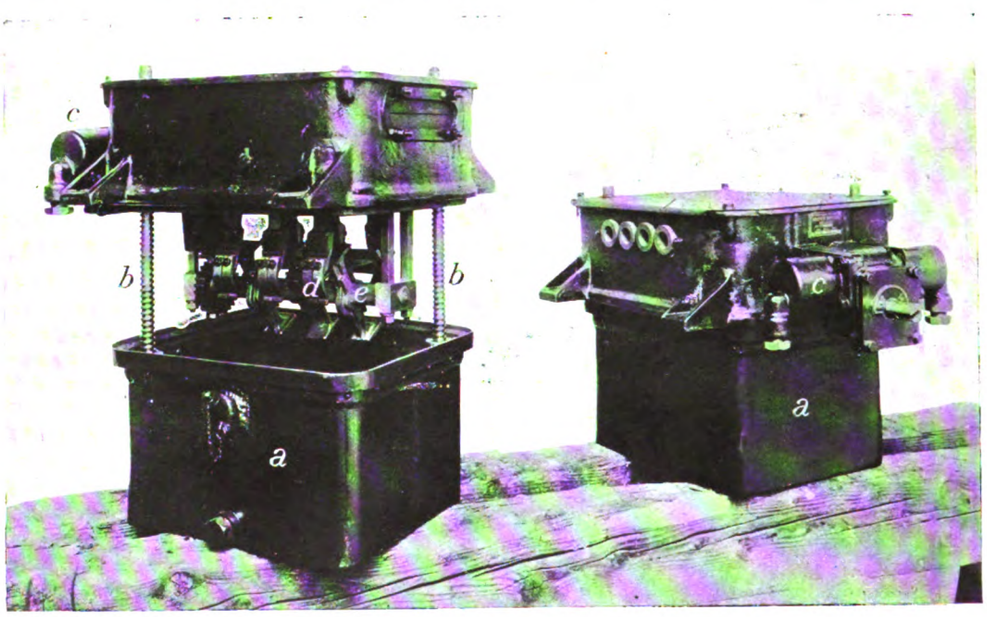
| | | | | | | *Miles per hour.* |
|---|---|---|---|---|---|---|
| 1. | Motors in series, | each with | 8 | working poles | ... | 23 |
| 2. | ,, | ,, ,, | 6 | ,, | ... | 31 |
| 3. | ,, | parallel, ,, | 8 | ,, | ... | 46 |
| 4. | ,, | ,, ,, | 6 | ,, | ... | 62 |

The two traction motors have their stator windings arranged star fashion when working in series with six poles, and also when in parallel either with six or eight poles, but when they are working in series with eight poles the stator winding of the secondary motor is thrown into a delta connection in order that the voltage in starting resistances shall not exceed about




*a.*—Oil case.
*b, b.*—Screws for raising and lowering cover
*c.*—Moving contacts.
*d.*—Cams operating *c.*

**Resistance Regulator.**




*a.*—Oil case. *b, b.*—Screws for raising cover. *c.*—Air cylinders. *d.*—Fixed contacts. *e.*—Cylinder with moving contacts.

**Star and Delta Connecting Switch for Stator Winding of Secondary Motor.**

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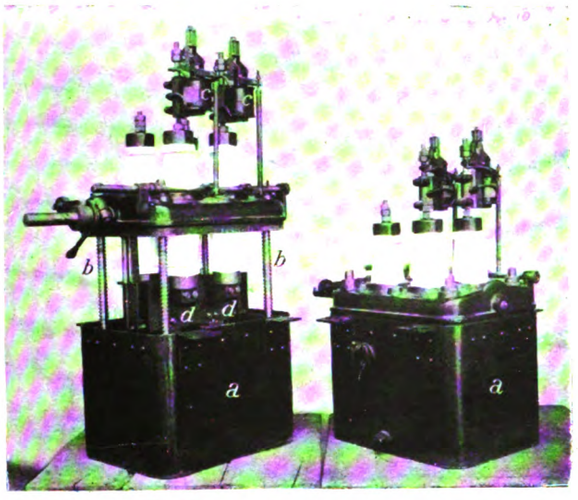
2,000 volts. By "secondary motor" is meant the following:—If we call the primary motor that which receives line current only in its stator, the secondary motor is that which is fed either by line current in its stator, or in its rotor by current from the rotor of the primary motor. That is, by way of divergence from the methods used in the 1-C-1 type of polyphase locomotive, when working in series the current-inducing member of the secondary motor rotates, while the member in which current is produced is fixed. Moreover, whereas in the 1-C-1 type the current led into the traction motors is either three phase or double phase, in the new type it is always three phase. The number of poles either in stator or rotor is as usual varied from six to eight by changing the coil connections through appropriate switch gear. There are therefore the following principal appliances used for electric control:—

1. Two commutator switches for varying the stator coil connections and consequently the number of poles.
2. Two commutator switches for similar action in regard to rotor coil connections.
3. Speed regulator, connecting the two traction motors in series or in parallel.
4. A commutator switch for joining up the secondary motor stator winding either in star or delta group.
5. Automatic circuit breaker for the traction motors.
6. Reversing switch for running backwards.
7. Metallic starting resistance, with regulator and special arrangement for throwing part of the resistance either into series or parallel.

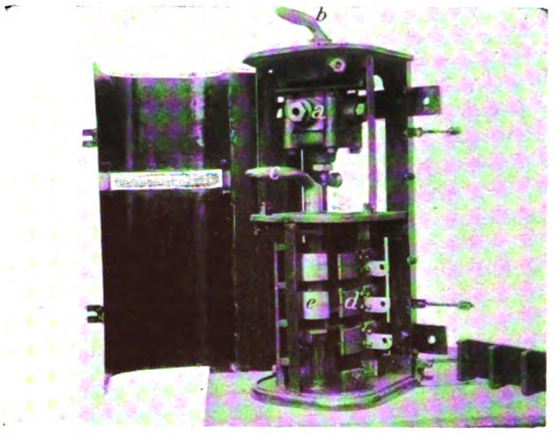



*a.*—Oil case.
*b, b.*—Screws for raising and lowering cover.
*c.*—Maximum current discharge coils.
*d, d.*—Fixed switch contacts.

**Transformer Cut-out.**

For the auxiliary mechanism of these locomotives there are provided in addition two 20-KW. three-phase transformers, which reduce the line current voltage in the ratio of 30 to 1. Through these transformers are fed two three-phase motor compressors, which give the compressed air used for braking and also for actuating the main electric gears connected with the traction motors. Two fans are installed for air cooling the traction motors and resistances; also four separate knife switches controlling the two sets of overhead collector bows at each end of the locomotive; two impedance coils, one for each of the two phases in the two overhead wires; and two roller contact lightning dischargers, one for each overhead wire or phase. These dischargers are arranged in special boxes of incombustible and insulating material. There are further two transformers, one for each phase of the overhead circuit, in the circuits of which are installed four ammeters, two in each locomotive cab; and two similar transformers for wattmeter circuits, one in each cab.

All the high-tension apparatus and appliances are placed in a compartment between the two traction

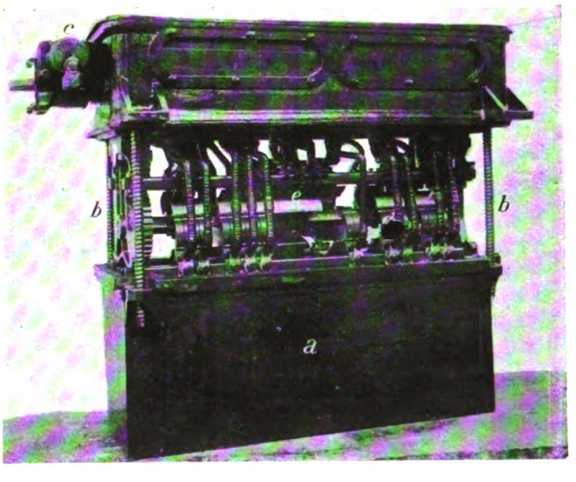



*a.*—Air valve for raising trolley bows.
*b.*—Portable key controlling valve *a*.
*c.*—Push-button for compressor switch.
*d, e.*—Fixed and moving contacts of switch.

**Compressed Air Controller for Raising and Lowering Trolley Bows, also Switch for Air Compressors.**

motors and in the centre of the locomotive (a driver's cab being provided at each end), and they are also locked by a lever key that serves to actuate the pneumatic lifter for the collector bows on the locomotive roof. The traction currents from the overhead collector bows pass first through the four main knife switches, then branch out through the lightning arresters and impedance coils into the automatic circuit breaker for the traction motors, thence to the primaries of the wattmeter transformers and the direction-reversing switch. Here the two currents from the overhead wires separate again, those of one phase passing to the running speed regulator and the windings of the primary traction motor, while those of the other phase go to the running speed regulator and the commutator switch for varying the poles of the primary traction motor.

The speed regulator, besides serving to put the traction motors either in series or parallel, has also the duty of connecting up to resistances at starting the




*a.*—Oil case.
*b, b.*—Screws for raising and lowering cover.
*c.*—Air cylinders.
*d.*—Fixed contacts.
*e.*—Cylinder with moving contacts.

**Speed Regulator.**

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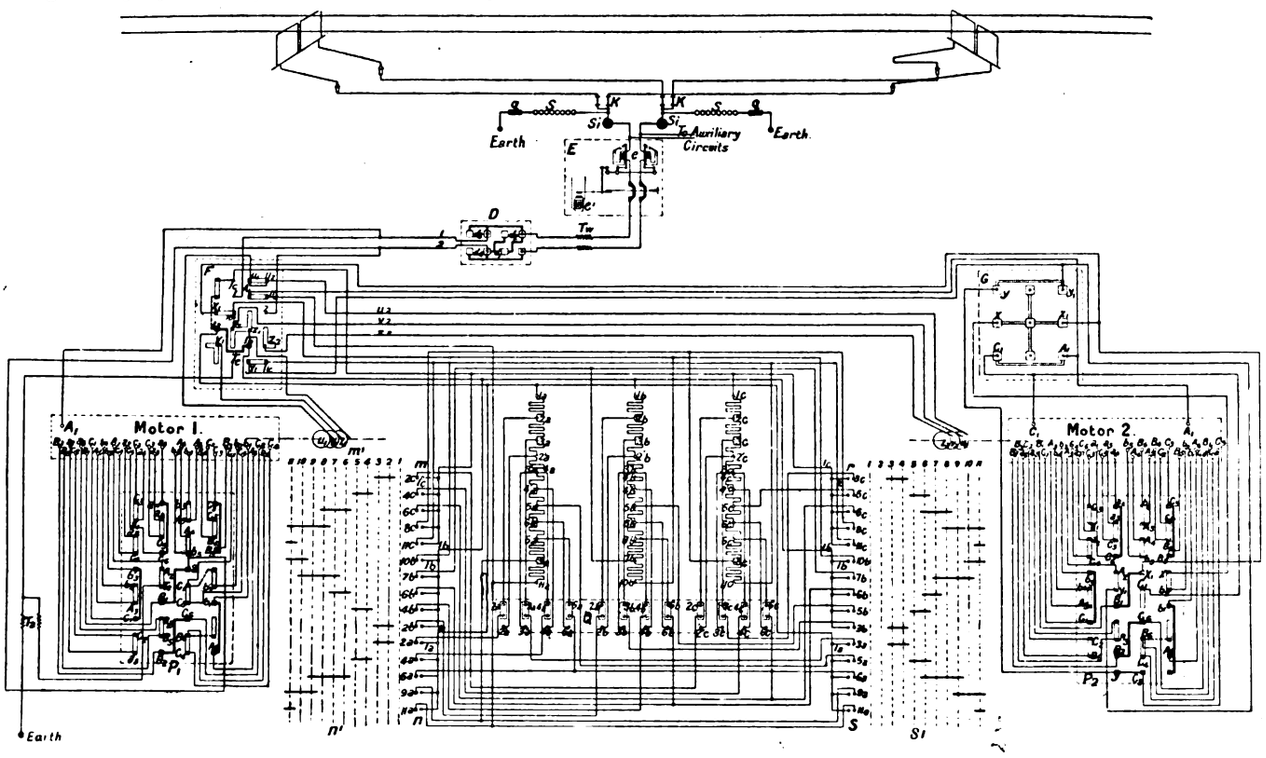
stator of the secondary motor, and both the rotors; it also provides electric connection between the rotor rings, the same resistances, and the stator of the secondary motor. These latter connections, however, are not made directly but by means of the stator pole switch, and of the commutating switch controlling the star and delta connections. It may be noted that no variation of resistance follows on the movement from zero point to first notch, the result of this operation being merely, in effect, to cause the closing of the main automatic circuit breaker, which is thus controlled by the resistance switch. The main circuit breaker acts on the overhead wire supply at two points on each phase, and is provided with two maximum current and one minimum current electro-magnets, the latter coming into play when pressure fails for any reason at the locomotive collector bows. The reversing switch changes over the two overhead wire phases when it is required to reverse the direction of running of the locomotive.

The auxiliary mechanisms of the locomotive are operated from the overhead wire circuit through separate automatic cut-outs and the primaries of the two transformers, the third phase of the latter being from earth through the locomotive framework. Six cables are led from the six divisions of these transformer secondary windings and are joined up two by two to form three conductors, one for each phase. In the two phases of the secondaries are inserted fuse cut-outs which protect the circuits from excess current, and also serve to cut out of circuit the secondary winding of one or other of these auxiliary transformers. The three conductors above mentioned are led to a commutator switch that allows the auxiliary appliances to be fed either from their own transformers or from the depot circuits when the locomotive is in the depot. From the commutator switch pass three conductors forming a three-phase line along the locomotive from which are taken branches for the different auxiliary working mechanisms.

To warn the driver of any possible overload liable to cause the transformer automatic circuit breakers to come out, two signal glow lamps in the cabs at each end of the locomotive are kept alight by the transformer secondaries; in the separate circuit of each lamp is inserted a small switch controlled by the respective circuit breaker, so that if the breaker opens the lamp goes out.

On emergency the main automatic circuit breaker protecting the traction motors may be operated independently of the main controller apparatus by a push button on each main controller frame in the locomotive cabs opening two small switches in the magnet circuit of the minimum current cut-out, so cutting the magnet winding circuit and operating the breaker. Two of the four main ammeters provided serve to show the volume of current passing through the primary motor from the overhead circuit; and the other two are used




$A_1$ to $A_6$. $a_1$ to $a_6$. $B_1$ to $B_6$. $b_1$ to $b_6$. $C_1$ to $C_6$. $c_1$ to $c_6$. } Free ends of stator windings—traction motors.
$D$.—Reversing gear for locomotive.
$d_1$, $d_2$, $d_3$, $d_4$.—Moving contacts of reversing gear.
$E$.—Automatic main switch for traction motors.
$e$. Minimum voltage coil on main automatic switch.
$F$.—Speed regulator.
$G$.—Star and delta connection switch.
$K$, $K$.—Knife switches for overhead wire collector bows.
$m$, $n$, $r$, $s$. } Fixed contacts—resistance regulator.
$m_1$, $n_1$, $r_1$, $s_1$. } Moving barrel contact segments—resistance regulator.
$P_1$.—Stator pole commutator switch primary traction motor.
$P_2$.—Stator pole commutator switch—secondary traction motor.
$Q$.—Resistance commutator switch.
$q$, $q$.—Carbon resistances in series with lightning dischargers.
$S$, $S$.—Roller contact lightning dischargers.
$Si$, $Si$.—Impedance coils.
$Ta$. Primary winding of transformer for ammeter.
$Tw$. Primary winding of transformer for wattmeter.
$u_1$, $v_1$, $z_1$.—Primary traction motor contact rings.
$u_2$, $v_2$, $z_2$. Secondary traction motor contact rings.
$vv_1$, $yv_1$.—Extra fixed contacts for joining up the secondary traction motor with speed regulator $F$ and with star delta switch $G$.
1$a$ to 11$a$. 1$b$ to 10$b$. 1$c$ to 11$c$. } Starting resistances.

**Wiring Connections for Traction Motor and Controller.**

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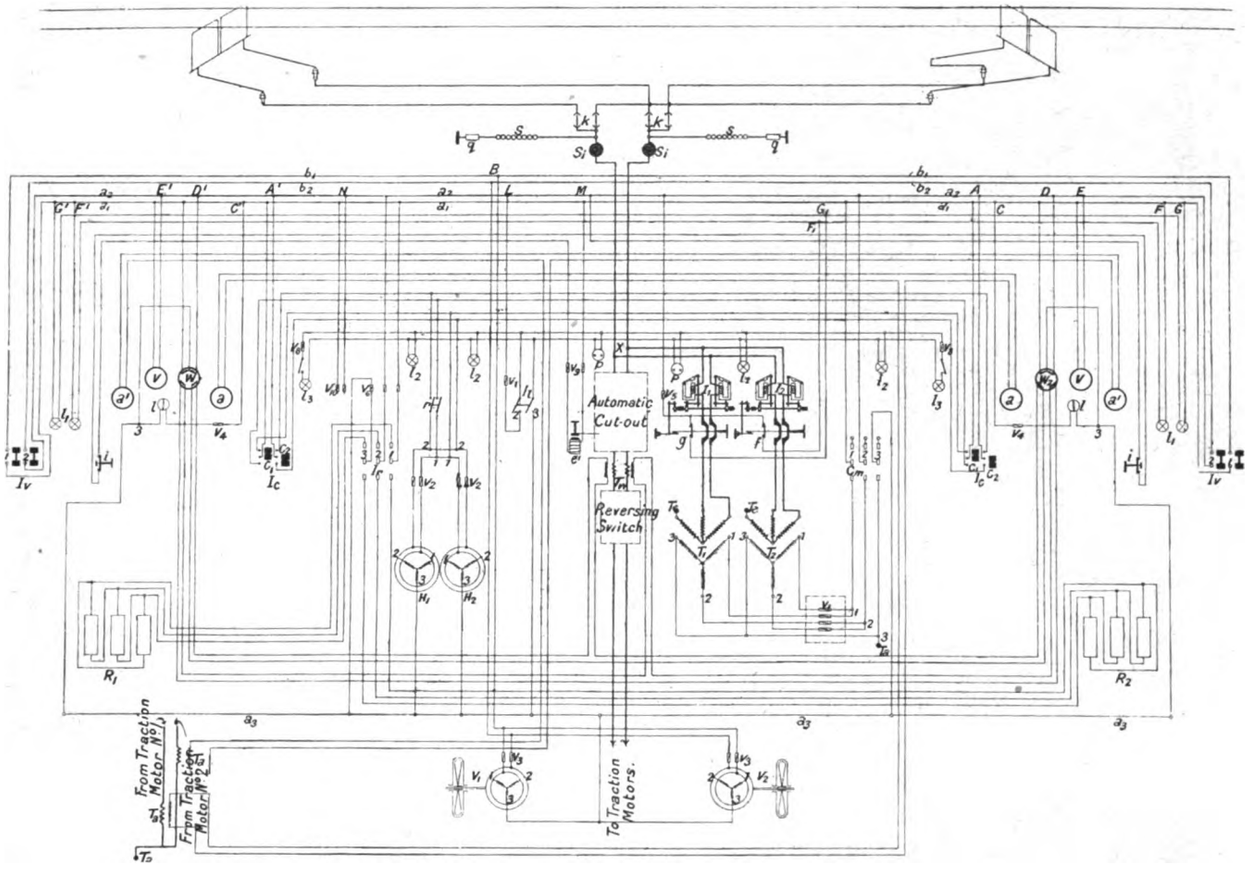
for the secondary motor current from the overhead lines, being cut out when the motors are arranged in series.

The main hand or driving control of the locomotive is of course in duplicate, for the two cabs, one at each end; and the principal controlling mechanisms are operated by compressed air through the main controllers. These have each three handles, the central one is for reversing the direction of running, and at the same time switching off the ventilating fan motors; that on the driver's right for closing and opening the main automatic circuit breaker, also for working the resistance regulator; while the third, on the left, is used for the simultaneous control of the motor-pole commutator, of the speed regulator, and of the star or delta connection commutator switch. This third handle, therefore, controls the speed of the locomotive.

Besides these handles on the controller top plate, there is also, in the right-hand front corner, the push button switch already referred to as an emergency opener of the main circuit breaker.

In front of the driver, above the controller, are mounted the measuring instruments—voltmeter, wattmeter, and two ammeters—while on his right under the cab roof is placed a small switch and fuse board, carrying the two signal lamps from transformer switches, with switches and fuses for the fan motors, cab lights, measuring instruments, etc., etc. Below this board, on a level with the main controller, are the two Westinghouse brake cocks, for normal and emergency stops.

On the left of the main controller is the subsidiary controller with compressed air tap for lifting or lowering the four overhead collector bows, also an interlocking




$a_1$, $a_2$, $a_3$.—Three-phase low tension circuit.
$a$, $a$, $a_1$, $a_1$.—Ammeters in locomotive cabs.
$A$, $A_1$.—Branch leads feeding compressor motors.
$b_1$, $b_2$.—Branch leads feeding fan motors.
$C$, $C$.—Branch leads feeding lamp for measuring instruments.
$Cm$.—Change-over switch connecting auxiliary apparatus mains either to overhead line wires or to depot circuits.
$D$, $D_1$.—Connections to voltometric coils of wattmeter.
$E$, $E_1$.—Voltmeter connections.
$F$, $F_1$, $F_1$, $G$, $G_1$, $G_1$.—Connections for signal lamps $l_1$, to show opening of transformer automatic circuit breaker.
$f$, $g$.—Small switches to keep signal lamps automatically off or on according as transformer circuit breakers are open or shut.
$H_1$, $H_2$.—Motors for pneumatic compressors.
$I_1$, $I_2$.—Transformer automatic circuit breakers.
$Ic$, $Ic$.—Hand-operated switch for compressors, controlling pressure regulator in or out of action.
$Il$.—Two-phase switch for locomotive cab lighting.
$Ir$.—Electric heater switch.
$Iv$, $Iv$.—Fan motor switches.
$K$, $K$.—Knife switches for overhead wire circuits.
$L$.—Branch lead for locomotive fixed and portable electric light.
$l$, $l$.—Lamps for lighting measuring instruments.
$l_1$, $l_1$.—Signal lamps indicating off or on position of transformer automatic circuit breaker.
$l_2$, $l_2$, $l_2$, $l_2$.—Lamps for lighting central (high tension) compartment of locomotive.
$l_3$, $l_3$, $l_3$.—Locomotive cab lights.
$M$.—Branch lead to minimum tension coil of main automatic circuit breaker.
$N$.—Connection to interlocking circuit.
$p$, $p$.—Plug sockets for portable lamps.
$q$, $q$.—Carbon resistances in series with lightning dischargers.
$R_1$, $R_2$.—Electric heaters.
$r$.—Air pressure regulator.
$S$, $S$.—Lightning dischargers.
$Si$, $Si$.—Impedance coils.
$T_1$, $T_2$.—Three-phase transformers (1 to 30 ratio) for auxiliary apparatus circuits.
$Ta$, $Ta$.—Transformers for ammeters.
$Tw$.—Transformers for current coils of wattmeters.
$V_1$, $V_2$.—Traction motor and resistance coils ventilating fans.
$v$, $v$.—Voltmeters.
$v_1$ to $v_{10}$.—Fuse plugs.
$X$.—Branch leads from overhead line phases for feeding the transformers.
$W$, $W$.—Wattmeters.

**Wiring Connections for Auxiliary Circuits.**

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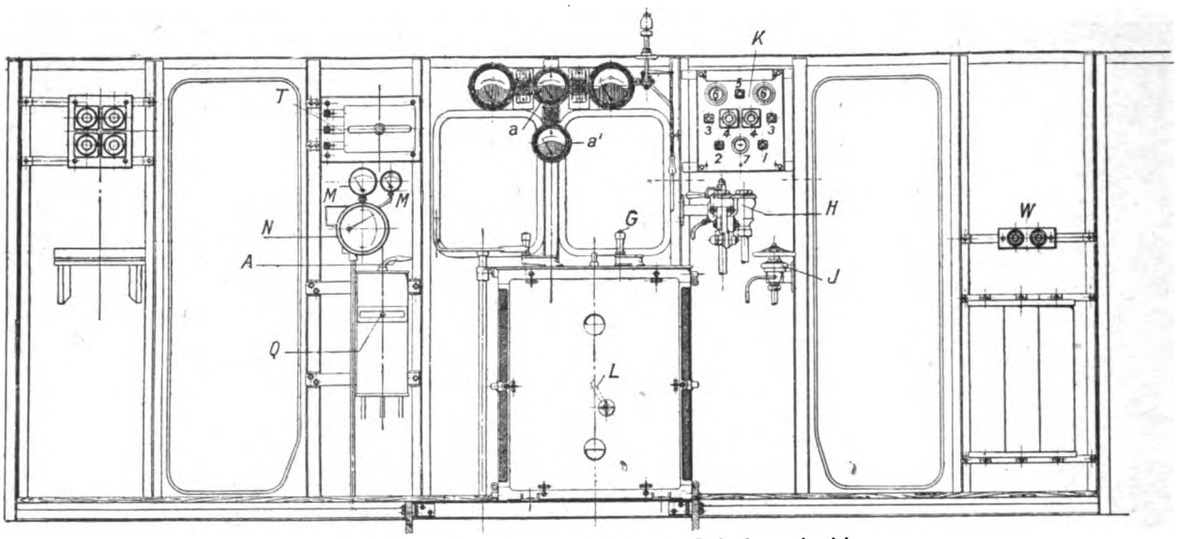
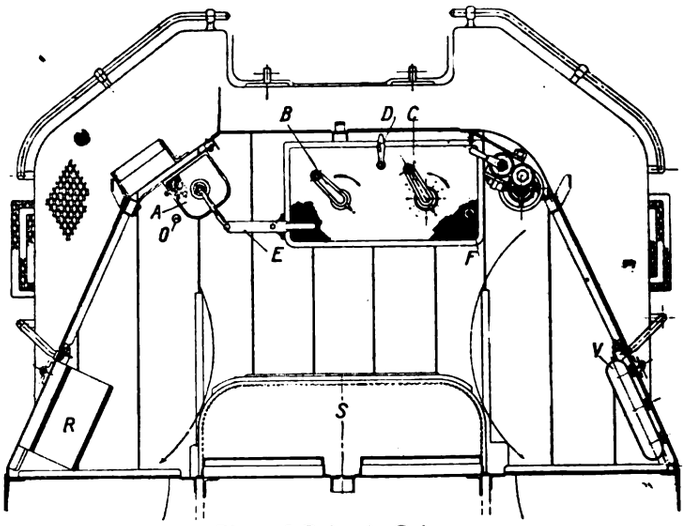
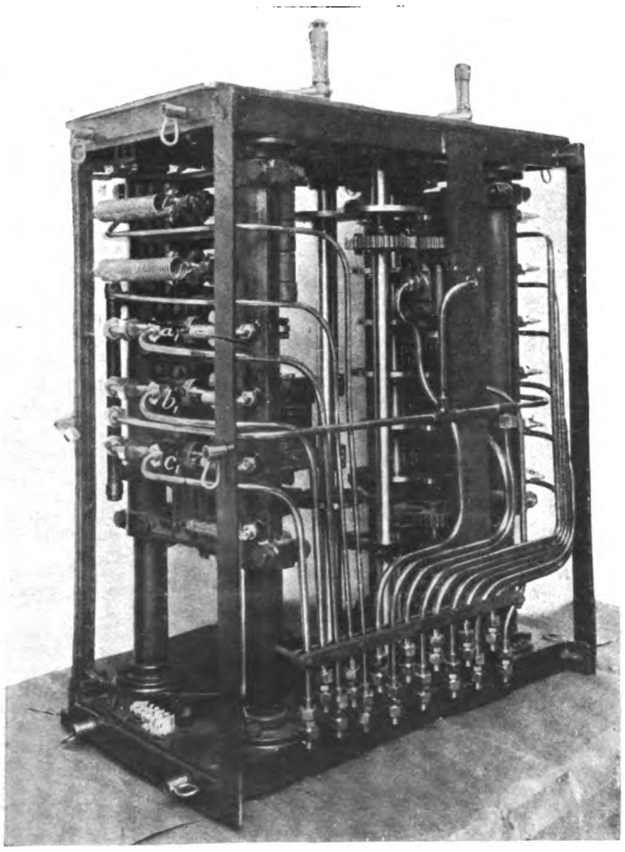



**End View (Developed) of Driver's Cab from Inside.**

*A*.—Controller operating collector bows.
*a*, $a_1$.—Ammeters for primary and secondary traction motors.
*D*.—Reversing gear handle; also control of ventilating fans.
*B*.—Controller lever for pole varying switch.
*C*.—Controller lever—resistance regulator.
*E*.—Hand brake lever.
*F*.—Emergency push-button operating main automatic switch.
*G*.—Push-button for alarm whistle, fixed in handle of controller lever.
*H*.—Hand valve—instantaneous application—Westinghouse brake.
*J*.—Hand valve, slow-acting Westinghouse brake.
*K*.—Switchboard. 1. Fuse for cab lights. 2. Fuse for instruments. 3. Fuse for interlocking circuit. 4. Fuse for ventilating fan. 5. Fuse for signal circuits. 6. Tell-tale lamp on auxiliary plant trans. switch. 7. Switch for cab lights.
*L*.—Collector bows controller lever in position to unlock main gear.
*M*.—Air pressure gauges. *N*.—Speed indicator.
*O*.—Compressed air pipe.
*Q*.—Lever controlling two-pole switch for air compressor motors.
*R*.—Lift-up desk. *S*.—Tool-box.
*T*.—Three-pole throw-over switch connecting secondaries of auxiliary plant transformers either to overhead wire circuit or to depot circuit.
*V*.—Electric heater.
*W*.—Switches for current from trolley wires.




**Plan of Driver's Cab.**



**Back View of Main Controller Frame.**

*a*, *b*, *c*.—Air valves controlling compressed air supply to 3-cylinder motor operating resistance regulator.

switch that controls the air compressors. The compressed air lever has four positions :—

1. All bows raised.
2. Forward bows raised.
3. Rear bows raised.
4. All bows lowered.

The hand brake spindle and arm are attached to the left-hand side of the main controller, between it and the subsidiary controller just mentioned. On the front of the latter is also a short projecting handle working in a horizontal slot; this operates the double-pole switch controlling the air compressor motor. A revolution speed indicator and two pressure gauges are installed above the subsidiary controller for use in connection with the compressor plant; and on a switchboard above these instruments there are installed in the forward cab of the engine the necessary fuses and a three-pole commutator or throw-over switch for the secondaries of the auxiliary plant transformers, so that these can be fed by induced current from the overhead circuit, under running conditions, or from the depot circuits when the locomotive is in the sheds. The rear cab of the engine has a switchboard similar to that already described as fixed in the front cab, also a three-pole switch for electric heaters in each cab. Two plug switches at each end serve for flexible lamp connections to enable close inspection of all working parts.

Although "front" and "rear" cabs are here mentioned, it will, of course, be understood that in all practical respects they are similar; the front cab is merely that from which the locomotive as a rule is driven, as obviously the design of auxiliary mechanism is much simplified if the locomotive can always (or

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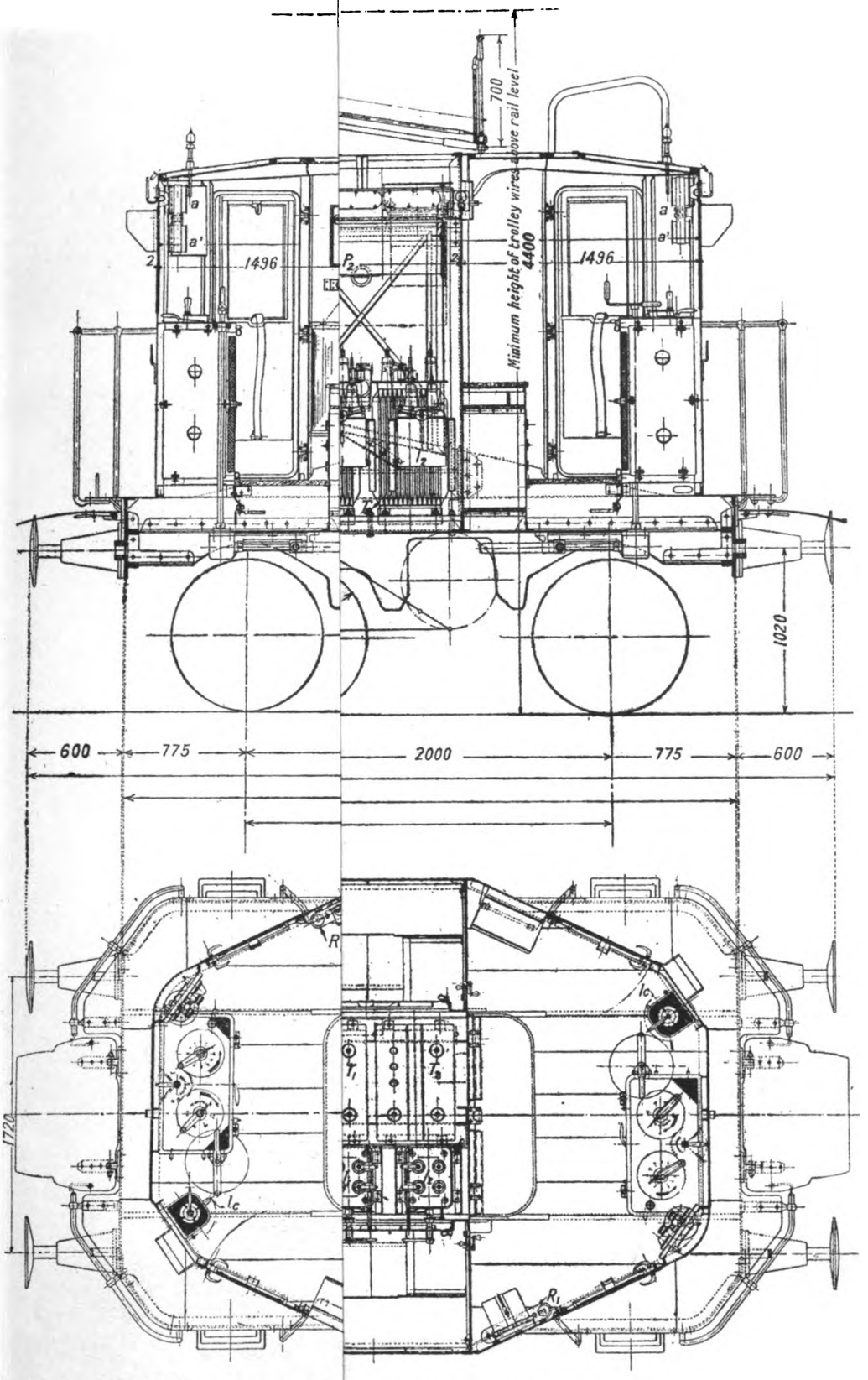


*A*, *A*, *a*, *a*.—Ammeter for primary traction
$A_1$, $A_1$, *a*, $a_1$.—Ammeter for secondary tracti
*D*.—Reversing gear for locomotive.
*E*.—Automatic main switch for traction mot
$H_1$, $H_2$.—Air compressors.
$I_1$, $I_2$.—Automatic transformer switches for au
*Ic*, *Ic*.—Subsidiary controllers.
*S*.—Lightning discharger.
*Si*.—Impedance coils.
$T_1$, $T_2$.—Transformers for auxiliary mechanisms.
*Ta*.—Transformer for ammeter.
*Tw*.—Transformer for wattmeter.
$V_1$, $V_2$.—Ventilating fans for traction motors and resistances.

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*A.*—
*a*, $a_1$
*D.*—
*B.*—
*C.*—
*E.*—
*F.*—
*G.*—
*H.*—
*J.*—
*K.*—
*L.*—
*M*—
*O.*—
*Q.*—
*R.*—
*T.*—
*V.*—
*W.*—

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*a, b.*

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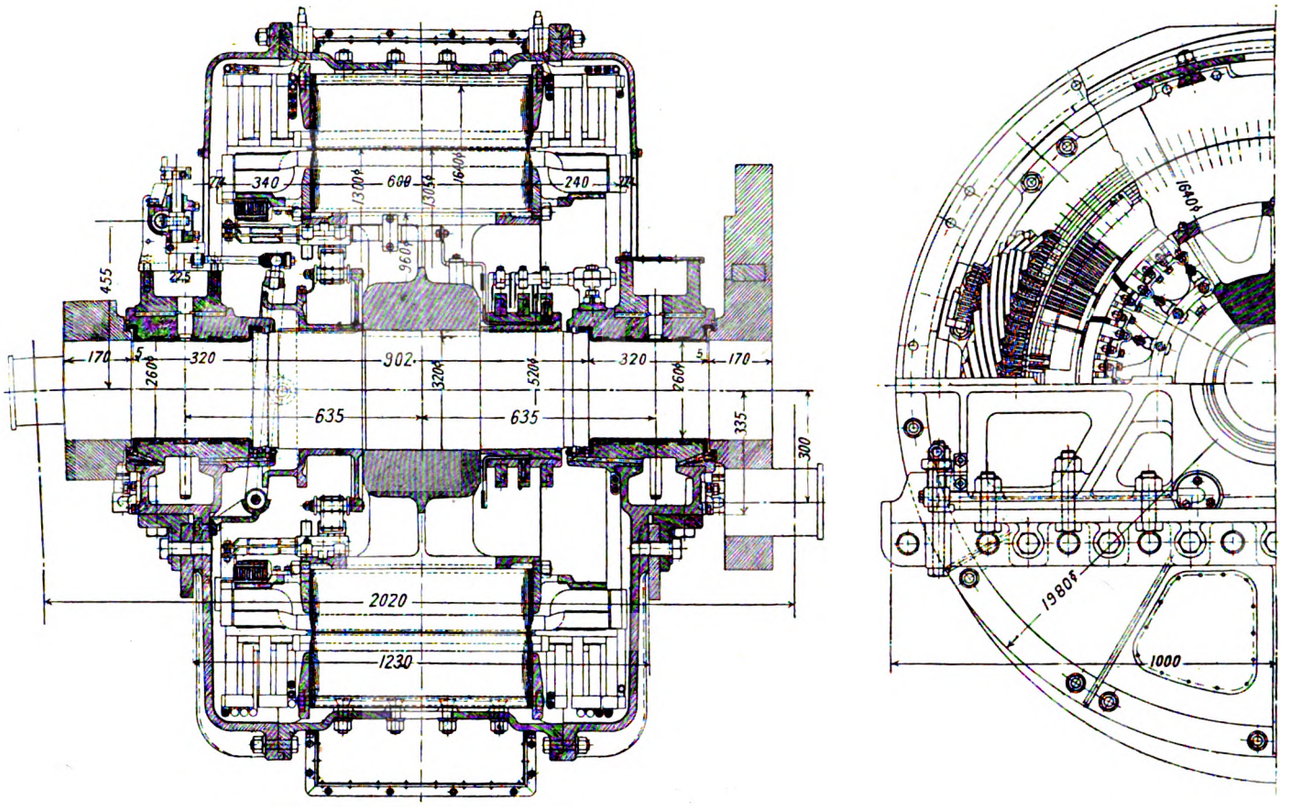
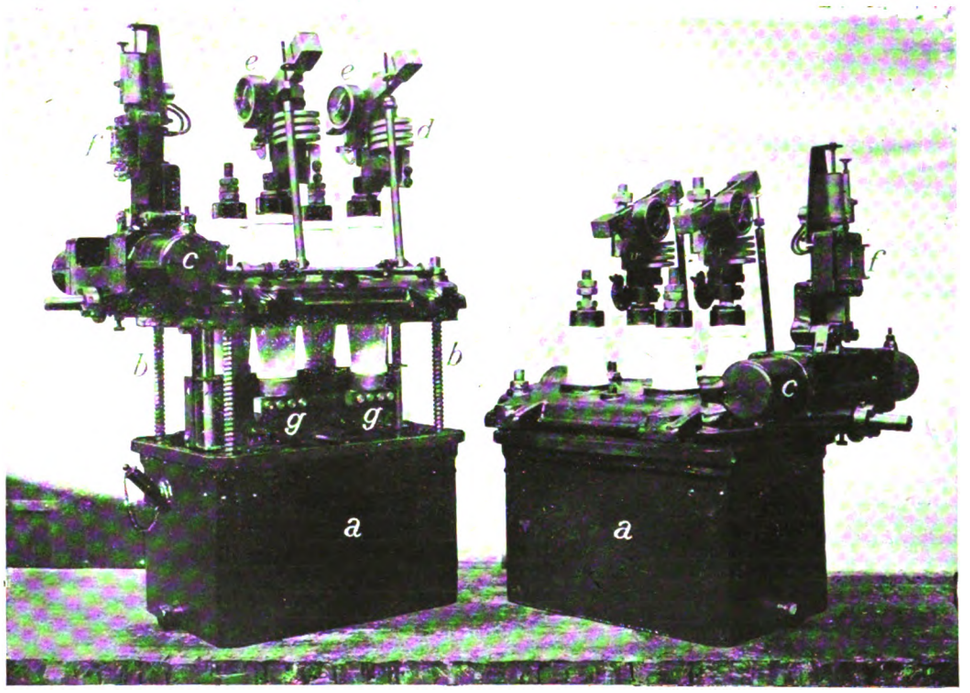



Sectional Views of Traction Motor.




*a.*—Oil case.
*b, b.*—Screws for raising and lowering cover.
*c.*—Air cylinders.
*d.*—Maximum current discharge coils.
*e.*—Time discharge.
*f.*—Mimimum current discharge coils.
*g.*—Fixed contacts.

Automatic Circuit Breaker for the Traction Motors.



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nearly so) run in one direction, the exceptions being principally for shunting purposes.

As already mentioned, all the important control appliances (automatic main switch, motor reversing switch, throw-over main switches for changing the number of poles in stators and rotors, speed regulator, star and delta connection switch) are operated by compressed air through one, two, and three-cylinder motors. Air for operating the main automatic switch can only be admitted into its motor after the auxiliary controller is set to allow one of the collector bows to be raised to the overhead wires, and this can moreover only be done to the main switch in one cab at a time; and similarly with the other apparatus, when one cab is used for driving, compressed air is cut off entirely from the other.

The handle of the subsidiary controller through which are operated the air compressor switches, and also the air valve admitting compressed air into the collecting-bow lifters and lowerers, is made removable, so that it can be taken off and used as a key to open or close the high-tension compartment on the locomotive. It can also be employed, by insertion through a suitable opening in the front of the main controller case, to free the interlocking mechanism that would otherwise prevent any movement of the main automatic switch and the resistance regulator with their compressed air gears even for testing purposes, so long as no current is entering the locomotive.

As regards the traction motors, the stator carcases and also the rotor wheel frames are of cast steel, carrying soft iron laminated cores; the coil windings of usual drum type are set in half open grooves. The motors are almost entirely enclosed, there being only two semi-circular openings for inspection purposes which are thereafter closed by removable plates. Air for ventilating and cooling the motors is forced from the fan into a ventilating space arranged in the periphery of the stator carcase and thence through the rotor.

The auxiliary mechanisms controlling the high-tension gear are set in oil baths from which they are lifted or into which they are lowered in each instance by four screws fitting through the iron oil case and lid carrying the gear. These screws are inter-connected by chains and toothed wheels, so that operating any one has the effect of operating all four.

As compared with the earlier type of electric locomotive—the 1-C-1 class—it will be seen that these new higher speed engines are three phase throughout, irrespective of running speeds. They do not require phase transformers, but, on the other hand, must be equipped with additional though less heavy apparatus for varying the number of poles. Series grouping is obtained by connecting up the rotors of the two traction motors, as well as by connecting the rotor of the primary motor with the stator of the secondary. The starting resistance and those for speed regulation are metallic, not liquid.

**Gattie's Goods Handling Scheme.**—Sir Albert Stanley, the President of the Board of Trade, received on November 23 a large deputation of members of Parliament and representatives of engineering, science, and commerce, who urged the necessity of dealing with the problems of transport in accordance with the scheme advocated by Mr. A. W. Gattie. Under this system for mechanical handling of goods and the creation of a central clearing house for rapid sorting, the employment of motor lorries would clear the streets of the congestion caused by horsed goods vehicles. It is estimated that the whole of the railway terminal work for goods traffic in London could be done at 1 per cent. of the space at present occupied, in 1 per cent. of the time now taken, and at 20 per cent. of the cost now incurred. The proceedings were private, but the deputation may be said to have been successful, for the President of the Board of Trade undertook to give the project a trial under Government transport auspices at some congested centre outside of London. The idea has thus advanced a long way since it was first received with derisive scepticism by railway experts.

## INSULATING CLOTHS.

Messrs. Abbott, Anderson and Abbott have done good service to the electrical industry in this country by the establishment at Harpenden of adequately equipped works for the manufacture of insulating cloths. Their enterprise in this direction and the excellence of their product deserve to be better known. Insulating cloths are, of course, essential to the manufacture of dynamos, motors, and various other electrical apparatus, but for many years British manufacturers had to rely for their supplies upon foreign sources. From America first, then from Germany and Switzerland, we were able to obtain insulating cloth and tapes of good quality and in any quantity required; a key industry thus remained wholly in the hands of our trade rivals. The position early attracted the attention of Messrs. Abbott, Anderson and Abbott, who have long been well known as makers of oilskin and waterproof clothing, and in 1905 they set themselves the problem of producing as good insulating cloths as could be obtained abroad. The problem was by no means so simple as it looked, and success was not achieved at a bound. Gradually, however, trade and technical difficulties were eliminated; and in spite of keen competition and the complete indifference of those whose business it ought to be to foster home industries, they built up a steadily-increasing business.

The preliminary work and the long course of experiments form an interesting example of the success of special aptitude, aided by patience and foresight. The principal difficulties were the obtaining of the right kind of cambric cloth and the most suitable varnish for coating it. Then in order to make the manufacture commercially successful it was necessary to design special machines so that the whole process could be carried out with efficiency and speed. A volume might be written to detail the successive steps in the improvement of the product, but it is sufficient to say that in the course of a few years Messrs. Abbott established a high reputation for their insulating fabric, and built up a fair business. When the war broke out the demand largely increased, but early in 1916 progress was for a time interrupted by a fire which almost completely destroyed the Harpenden works. The firm at once began to design and equip new premises, but the difficulty of obtaining materials and machinery rendered the reconstruction a somewhat protracted business. While the work is not wholly finished, it is a notable achievement that in the present conditions a new plant capable of turning out 750,000 yards of insulating cloth in a year is now in operation. The output will be doubled when the rebuilding is completed.

The new works were built by Messrs. Trollope and Colls to the design of Mr. Charles W. Latter, with Mr. H. Kempton Dyson as consulting engineer. They comprise a number of well-lighted rooms and a large ferro-concrete tower, shown in one of the accompanying illustrations. Externally of severely simple design, the interior arrangements have been carefully devised for the purpose in view. The tower contains several shafts suspended from the upper storey and terminating at the first floor level. These shafts have double walls to prevent the diffusion of heat, which is regulated by steam pipes. At the base of the shafts are baths of insulating solution for the impregnation of the cloths. After immersion these are led up over drums driven by pulleys to the top of the building, then down the next shaft to a second bath, after which they are again drawn to the top of the tower. By the time the cloth has again reached the ground floor it has been sufficiently dried in the steam-heated atmosphere to be wound into rolls. Before the cloth is ready for this

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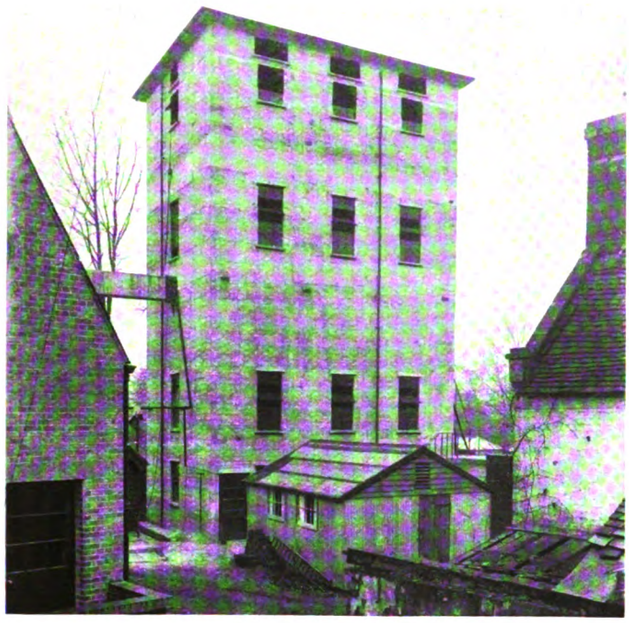
treatment it has to be cut and re-sewn on the bias. Cloth-makers weave the thread at right angles, and if the cloth were treated as it is received it would not have sufficient strength, and would fray when cut into strips. Special sewing machines with wide lockstitch have been designed, and after the cloth has been cut



**Ferro-Concrete Tower in which the Cloths are Treated with Insulating Solution.**

on the bias the pieces are sewn together by operatives who work in well-lighted rooms under excellent conditions. The cambric is supplied in thicknesses of from 5 to 15 mils, and the silk in thicknesses of from 4 to 6 mils. After being sewn in lengths up to one hundred yards, the cloths, which vary in width up to 38 inches, are taken to the tower and coated with black or transparent yellow insulating liquid. When this process is completed the cloth is inspected and rolled. It is then ready to be cut into tapes of any required

**Cutting and Re-sewing the Cloth before Treatment.**

width. This is done by a simple and ingenious machine, shown in Fig. 3. The roll is placed on a drum at the base and the fabric runs up over spindles fitted with a series of circular steel cutters, which smoothly and with perfect accuracy cut the cloth into tapes of any desired width, each section of tape being wound in a direction opposite to that of the next section.

By the courtesy of Messrs. Abbott, Anderson and Abbott, representatives of the technical Press were recently enabled to visit the new works, and an interesting and instructive morning was spent in inspecting the arrangements and the process of manufacture. On the occasion of the visit the firm were represented by Mr. W. G. Abbott, managing director, and his brothers, Messrs. F. Abbott, C. W. Abbott and E. Abbott, and Mr. Edgar S. Barralet, head of the sales organisation for insulating cloths, tapes, and silk.

The war has proved how important it is that Great Britain should be capable of manufacturing her own requirements in all necessary materials. Varnished fabrics and tapes are essential in the manufacture of heavy electrical machinery, and varnished silks for the magneto and instrument trade, and it is to be hoped that our manufacturers will, as far as possible, support the new enterprise.

## DIFFERENTIAL GEARS AND RAIL CORRUGATION.

By R. H. Wilkinson.

*(General Manager and Engineer, Huddersfield Corporation Tramways.)*

Very little can be added to the account which I gave in The Tramway and Railway World of May 11, 1916, of the experiments which have been made on the Huddersfield Corporation Tramways with differential gears. As there stated, 11 cars fitted with such gears have been in operation on this system since October, 1914. The route over which these cars have run is six miles in length, and a ten minutes' service is maintained by cars fitted with these gears.

The result of my longer experience is that I am more firmly convinced of their utility for the purpose for which they were installed, viz., the prevention of the formation of corrugations on the rails. They have been in use for three years on a section of line which was in parts badly corrugated. The corrugations were ground out three years ago, and so far have not reappeared. The current consumption is the same as on an ordinary geared car, although the tire wear is not so great, as shown by the following figures. :—

| | Differential gears. Miles. | Ordinary gears. Miles. |
|---|---|---|
| Average life of tires for $\frac{1}{8}$ in. wear ... | = 3,625 | 3,553 |
| ,, ,, pinions ... ... | = 56,612 | 54,254 |
| ,, ,, gear wheels for $\frac{1}{32}$ in. wear | = 22,620 | 24,855 |

One or two of the gear wheel rims had to be changed through breaking, due to defective castings, which accounts for their life being less.

**A Tape Cutting and Reeling Machine.**

From the above it is seen that there is less wear of tires with the differential gears. This is really more pronounced than appears on the surface, because the comparison has been made with similar types of cars which run on another section where the track is in a much better condition, being more recently constructed and mostly double, whereas the differentially geared cars run on a length of line which is chiefly single and in a bad condition, some of it very bad.

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THE

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LONDON, DECEMBER 13, 1917.

**Queues for Loading Cars.** Omissions stretching far back before the war have produced accentuated difficulties during the past three years. Industrial and commercial activity engendered by the needs of the Forces has so augmented the demand for passenger conveyance that a number of traffic authorities have been compelled to institute the queue system of loading. Even a health resort such as Bournemouth is experiencing the need. The tramway manager has been directed to report thereon, in consultation with the town clerk, as to the powers the tramway committee have, or would require, to carry the suggestion into effect. If a committee is in earnest there is no necessity to await the acquirement of powers. Proof of this contention is afforded by what has happened both before and since the war. There are numerous towns where queue loading has long existed without special authority having been acquired, and cases are not wanting of this example having been followed during the past eighteen months. As notable instances, Halifax and the London General Omnibus Company may be cited, while Bradford has secured from the Board of Trade a by-law under which queues must be formed at any stopping place at which more than six persons are waiting. The case of Halifax is interesting because of the adoption of a method that enables a number of queues to be formed without congestion at the termini of a number of routes. It has existed for years at the London County Council's Southwark Bridge terminus, and doubtless similar procedure obtains in provincial centres. By establishing the loading points at different places on both the inward and outward rails, a number of cars can be simultaneously filled. The adoption of this course would, no doubt, provide a remedy for the pushing now witnessed at the rush period at Victoria and other London termini, in consequence of which the borough councils have lately directed the attention of the police and traction authorities to the need for queues. Two or three years prior to the war the County Council secured statutory powers for queues, despite a police objection that Scotland Yard had no men to spare for the regulation of the system. At the present juncture it would be impossible for the Council to find a sufficient number of men to undertake the work, but it ought to be feasible for special constables to give aid. In Leeds the latter discharge the far more difficult work of regulating vehicular traffic at busy points, and the chief constable has lately devised a method of facilitating the carrying out of this duty at night, which might be usefully copied in London and elsewhere. Three electric lamps are employed, one showing red continuously on the back of the constable, and white and red lamps being carried in either hand. When the latter is visible oncoming vehicles must come to a halt until white is shown. Now that queues are the rule at food shops at certain hours in many populous centres, the example ought to facilitate the adoption of the system for passengers. Although it is more difficult to carry out for omnibuses than for tramcars, the London General Omnibus Company have been gradually bringing about its adoption during the past year. Efforts are now being made to secure extensions, and it is to be hoped that Sir E. Henry will facilitate the work of the management by granting the aid of special constables.

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**National Tramway Committee.** An indication of the increasing difficulty of maintaining means of local communication is the appointment at the instigation of the Government of a committee, which will be officially known as the Tramways (Board of Trade) Committee. Various preliminary steps have been recorded in earlier issues, and in the present number the narrative is, for the time at least, brought to a close. The foundation for the whole movement, put briefly, is the increasing difficulty which all tramway managers are experiencing in obtaining materials for maintenance and renewals, and also in keeping a sufficient supply of labour to continue services that are urgently required in the public interest. Such Government aid as has been given was divided between two departments, and hence was unsatisfactory. Several tramway managers who foresaw that matters could not longer continue as they were, urged the Board of Trade to take steps to deal with questions of supply that were becoming more urgent every day. The Government readily appreciated the necessity of keeping up the tramway services in numerous cases where the cars transport munition employees. The original idea of the Board of Trade seems to have been that there should be a tramway controller, but it was soon understood that the work could be better done by a committee. Negotiations were then opened by the Board of Trade and the Ministry of Munitions with the Municipal Tramways Association and the Tramways and Light Railways Association. The result was the formation of a committee, which at present consists of seven members, two appointed by the Board of Trade, three by the Municipal Tramways Association, and two by the Tramways and Light Railways Association. The duties and powers of the committee have not yet been fully defined, but they will no doubt be commensurate with the urgency of maintaining the tramway services of the country as far as possible under the present conditions. One of these duties, for example, will be to see that rails are made available for essential tramways requiring track renewal. Authority will also be given for the provision of additional cars where these are necessary. Steps may be taken to prevent further depletion of labour, and the help of the National Service department may be enlisted in providing the men requisite to maintain the services essential to the production of munitions. Not all tramways come under this category, and some undertakings where traffic is light and non-essential may have to submit to temporary curtailment or even abolition of services. The committee, which is fairly representative, may be trusted to act in such a way as to produce a minimum of hardship subject to ensuring services deemed indispensable. The position will be quite different from what it might be were similar powers to be exercised by a Government department knowing little or nothing about the business, its needs, and its circumstances. Every member of the committee is a tramway expert, thoroughly familiar with the exigencies of tramway operation.

**Development Procedure.** The insignificant number of tramway extensions included in the fifty applications for Acts and Provisional Orders next Session is not to be regarded as representative of local and national needs for increased transportation facilities. The war has enforced a suspension of all but imperative expenditure. Within this category fall the few applications relative to tramway extensions. The more numerous requests to the legislature and the Board of Trade relative to electricity undertakings represent work that must be executed either immediately or in the near future. These might have been even more numerous but for the linking-up schemes now under consideration at the instance of the Board of Trade. A number of these when carried into effect will have an important bearing upon the security and extension of traction loads. Present and future tramway extension requirements are to be found in the schemes that have been formulated in response to the request of the Reconstruction Committee for information as to the amount of municipal work to be put in hand after the war. Without doubt, their number will be added to when the conflict comes to an end and projects for making up the deficiencies of housing accommodation are translated into bricks and motor. Besides that development, traction authorities may be affected by the extent to which national effort will be directed to repopulating the country-

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side, in view of the paramount importance which native agriculture has attained in the maintenance of our existence. That tramway authorities are alive to the questions of housing and food production was shown by the reception given to Mr. A. Ellis's paper on development of tramways at the conference of the Municipal Tramways Association. There was unanimity as to the part that electric and, in its sphere, motor omnibus traction can play in the directions to which we have referred. Insistence was also placed upon the need for devolution in the method of granting tramway powers, and for removing the hindrances set up by outside local authorities. Possibly these desiderata would be attained if more municipalities followed the example of Sheffield and established a Development Department. This important work has been deputed to a new committee of the Corporation, who were also desirous of appointing a separate executive officer. It was found, however, that none of the forty applicants had had special experience of the work of a municipal authority, which the committee considers most desirable, if not essential. Under these circumstances the deputy town clerk has been appointed to the position and relieved of some of his present duties. We would suggest that in many places it would for good reasons be wise to combine the post with that of manager of the tramways. It is noteworthy that Sheffield's Development Committee recommends that for advisory purposes the principal officers of the Corporation, particularly the general managers of the tramways and motors and the electric supply departments, the city surveyor, the city architect, and the improvement surveyor be asked to co-operate to the fullest extent possible. This is a wise provision that has worked well in localities where town planning schemes have been formulated. The latter task ought to go hand-in-hand with tramway extension, and it is desirable that wherever there is land available for town planning, the preparatory work should not be delayed until after the war. In this respect the example of the Special Committee of Birmingham Corporation on road widening and new construction is to be commended. An outcome of it are the important recommendations submitted by Mr. Alfred Baker, the tramways manager, for future extensions and the method of working by single-deck two-car trains running on a reserved track. This innovation promises to revolutionise the cost of operation, and by its general adoption it should provide the system required for effectively developing outer urban and agricultural districts.

**Rule of the Road and Tramcars.** Inquiries have recently been made by several correspondents as to the exact state of the law and the liability of drivers of vehicles in regard to the passing of tramcars when overtaking. In reality there is, we believe, no uncertainty about the matter. In the early years of the present century, when motor cars began to come into general use, the rule of the road for drivers when overtaking tramway cars was found to need alteration. The Motor Cars (Use and Construction) Order, 1904, contained provisions which were interpreted to mean that a motor car overtaking a tramcar must pass on the off side. This simply applied the ordinary rule of the road to the case of overtaking a tramcar. As the latter, however, cannot deviate to the near side of the street, accidents arose in the process of passing, either through the motor car when on the off side meeting another tramcar or some other vehicle or running into pedestrians. This was the more likely to happen as the motor car driver could not see ahead until he had emerged to the right from behind the tramcar. The interpretation of the Order of 1904 was confirmed by a judgment in the case of Burton *v.* Nicholson, in the King's Bench Division, in the beginning of 1909. A tramcar was there held to be a carriage, and therefore the ordinary law applied. The Court, however, expressed the view that the law ought to be altered. In the following month (February), therefore, amending Motor Car Orders were issued by the Government, both for England and Scotland, under which the driver of a motor car was left to use his own discretion as to which side he should take in overtaking a tramcar, but the onus was left on the driver to use all proper care. A similar latitude was about the same time given by the Chief Commissioner of Police in Ireland. So matters have remained ever since. It was not long, however, before serious trouble arose from the discretion given to the

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motor car drivers and apparently to the drivers also of horse-drawn vehicles. When a tramcar is at a stopping place and passengers are getting out and in, drivers of other vehicles pass on the near side even more frequently than on the off. The tramcar passengers are scattered, and sometimes serious and even fatal accidents are caused. This subject was frequently discussed, and, notably, in February, 1913, by Mr. A. L. C. Fell, general manager of London County Council Tramways, when giving evidence before a House of Common Committee which was inquiring into the cause of accidents from power-propelled traffic in London. No legislation has been passed on the subject, but in one instance a remedy has been found for a particular town. This is the case of Glasgow, which, in April, 1915, secured the confirmation by the Secretary for Scotland of a series of by-laws for regulating the traffic in streets within the city. One of these by-laws provides that when a tramcar is standing at a stopping place every driver of a vehicle who intends to pass on the near side shall draw up immediately before arriving at the stopping place and wait until the roadway is clear of passengers entering or leaving the car. It will, no doubt, be generally agreed that it is not desirable to go back to the old law that the vehicle overtaking a tramcar must pass on the off side in all circumstances, but if liberty is allowed to pass on either side, some such rule as the one in use in Glasgow is obviously a great advantage for the safety of the public.

**Traffic Receipts.** The financial year of most of the municipal tramway undertakings of the country is now well advanced, while others and also the company undertakings are removed by some months from the dates when their twelve months' reckonings began. It is accordingly practicable to form an idea as to how receipts are going to run for the current year. Were it not for the fact that working expenses are higher, a glance over the list of aggregate traffic receipts indicates that the tramways of the country are in a state of great prosperity. Out of 68 undertakings whose aggregate traffic revenue to date we quote regularly, there are only five which show decreases as compared with the corresponding periods in the preceding year. These decreases, moreover, are small. In the majority of the other 63 cases, the increases revealed are substantial, and in some instances they are enormous. To look at matters from another point of view, take the traffic summary paragraph which is given at the foot of this column. It deals with traffics for the week ended November 24 on 38 of the principal undertakings. For a long time the weekly average revenue per mile of track open has substantially exceeded the figure for the corresponding weeks of last year. Indeed, for long the increase has on the average been above £10 per mile of track, or considerably over 10 per cent. It is, of course, the fact that a number of the undertakings have increased their fares in order to meet the higher expenses, but others have not. In the latter instances the rise in revenue has come from increased numbers of passengers. In fact, through activities connected with the war, the business with which many of the tramways have to cope with their reduced staffs is at times almost overwhelming. Even after allowing for heavy expenses and war allowances, it is quite likely that many of the tramways will at the end of the financial year show highly favourable results—as some did last year. But the careful manager will recognise that part of his surplus is fictitious. It represents money which in the ordinary way would have been spent either out of revenue or out of reserve for maintanance and renewals. The work of upkeep having been so largely suspended, owing to difficulties regarding both materials and labour, it is necessary to put aside large available surpluses to meet the time when after the war great sums will have to be spent in order to overtake arrears of maintenance.

## A WEEK'S TRAFFIC SUMMARY.

The official traffic returns of thirty-eight of the principal tramway undertakings in the United Kingdom for the week ended November 24 give total receipts of £195,727, or £37,804 more than in the corresponding week of last year. The total length of track included in the returns was 2,029 miles.

The receipts this year were at the rate of £96 9s. 4d. per mile of single track, and last year at the rate of £77 16s. 8d., thus showing an increase for the week of £18 12s. 8d. per mile open. Certain London and provincial tramways have temporarily discontinued the publication of traffic receipts.

**Board of Trade and Track Inspection.**—Complaints having been made to the Board of Trade by Musselburgh Council of accidents on the local tramways, the Board replied that "the responsibility for the proper maintenance of the undertaking rested with the promoters, and that the Board did not carry out any system of periodic inspection of tramways." The Council are dissatisfied with the reply, and propose to take further steps with the company.

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# THE NATIONAL TRAMWAY COMMITTEE.

The following are the members of the National Committee of Tramway Managers, the formation of which, at the instance of the Board of Trade, was reported in previous issues :—

James Devonshire (chairman), managing director, London United Tramways, Limited, the Metropolitan Electric Tramways, Limited, etc.

A. L. C. Fell, general manager, London County Council tramways.

J. B. Hamilton, general manager, Leeds Corporation Tramways.

J. M. McElroy, general manager, Manchester Corporation Tramways.

A. R. Fearnley, general manager, Sheffield Corporation Tramways.

R. J. Howley, joint manager, British Electric Traction Company, Ltd.

Stephon Sellon, consulting electrical engineer.

For the information of the members of the Municipal Tramways Association, the following summary was issued with reference to the negotiations which took place previous to the appointment of the committee and to the decisions which were arrived at by the Executive Council in regard to the matter :—

"In response to the request of the President of the Board of Trade, the Council of the Municipal Tramways Association, together with the Council of the Tramways and Light Railways Association, attended at the Board of Trade on November 2, and met the President (Sir Albert Stanley), together with representatives of the Ministry of Munitions. The President made a short statement suggesting the advisability of the appointment of a Controller to deal with tramway matters, and stated that he had seen Mr. James Devonshire, and that Mr. Devonshire had agreed to accept the position.

"The Executive Council of the Municipal Tramways Association pointed out, however, the serious objection which would arise by the appointment of a single Controller, as announced by the president, and they recommended to him the appointment of an Executive Board under the chairmanship of the gentleman already suggested as Controller.

"As a result of the conference which took place, the following letter was received from the Board of Trade :—

"'November 10, 1917.

"'Sir,—I am directed by the Board of Trade to state for the information of your association, that the President of the Board has decided, in view of the serious difficulties under which tramways are at present labouring, to set up an expert committee to consider the needs in respect of materials and labour of tramways essential to the prosecution of the war, and to take such steps as may be necessary to supply such needs even at some temporary sacrifice on the part of the less essential undertakings. The President is confident that he can rely on the assistance of your association in this important matter, and he would be glad if the Municipal Tramways Association would be good enough to nominate at the earliest possible moment three representatives to serve on the committee. I am to add that it is proposed that Mr. James Devonshire should be the chairman of the committee.—I am, Sir, your obedient servant,

ERNEST J. MOGGRIDGE.'

"The Executive Council of the Municipal Tramways Association held a meeting in Manchester on Wednesday, November 14, and nominated the following three gentlemen to serve on the committee : Mr. J. B. Hamilton (chairman of the Executive Council), Mr. J. M. McElroy (past-president), and Mr. A. R. Fearnley (hon. secretary).

"The committee therefore will now consist of the three representatives nominated by the Municipal Tramways Association, Mr. A. L. C. Fell, representing the London County Council Tramways (nominated by the Board of Trade), two members nominated by the Tramways and Light Railways Association, chiefly representing company-owned tramways, and the chairman (Mr. James Devonshire), nominated by the Board of Trade.

"Up to the present we are informed that the question as to exactly what matters are to be referred to the committee has not been settled.

"The President and the Executive Council requested me to give this early intimation setting out what had passed in regard to this question for the information of all the members of the Association, and also to clearly point out to them the fact that the municipal interests which so largely predominate in tramways were being adequately safeguarded by the Executive Council.

"It should be noted that the composition of the committee provides for four Municipal Tramways Association representatives and two Tramways and Light Railways Association representatives and the chairman, so that no question is likely to arise regarding undue prominence being given to company interests to the detriment of municipal interests.

"A. R. FEARNLEY, Hon. Secretary.

"Division Street, Sheffield. November 15, 1917."

### LONDON COUNTY COUNCIL'S ATTITUDE.

At a meeting of the London County Council, on November 27, the following report by the General Purposes Committee was submitted :

"A letter in terms as follows having been received from the Board of Trade, we decided to ask the Highways Committee for their views thereon—

"'November 10, 1917.

"'Sir,—I am directed by the Board of Trade to state, for the information of the London County Council, that their attention has been called by the Ministry of Munitions to the fact that some of the tramway systems of this country essential for the production of munitions of war are, owing to the difficulty in obtaining material and labour for repairs, reaching a condition in which a serious breakdown may be expected unless steps to provide a remedy are taken forthwith. In these circumstances the Board propose to appoint an expert committee to whom these matters could be referred, and who would take such steps as they may see fit, subject to the approval of the Board, to meet such needs. The Board recognise that for its successful working the co-operation of the London County Council is essential, and they would therefore ask the Council to be so good as to authorise Mr. A. L. C. Fell to serve on the committee. The Municipal Tramways Association and the Tramways and Light Railways Association will be invited to nominate three and two members of the committee respectively, and it is proposed that Mr. James Devonshire should be the chairman.

"'The Board trust that the Council will understand that there is no intention to interfere with the control of the tramways, subject to the considerations indicated above. It might, for example, be necessary in some cases where tramways of one authority were deemed to be essential, and materials for necessary repairs were otherwise unobtainable, to require another undertaking to provide such materials either by conversion of double to single line, or by temporarily abandoning certain routes altogether, and transferring both track and rolling stock to routes of the other undertaking.

"'The Board have no doubt that the Council will willingly co-operate with them in the object they have in view.—I am, Sir, your obedient servant, (Signed) ERNEST J. MOGGRIDGE.'

"The Highways Committee have informed us of the circumstances which have led up to the appointment of the expert committee, and they express the opinion that the committee set up by the Board of Trade should be constituted on a basis securing representation of the municipal and private interests concerned proportionate to their magnitude. The Highways Committee further express the view that it is important that the chairman of such a committee should be entirely free from association with any traffic undertakings likely to be affected. Failing any change in the proposed constitution of the committee, in regard to which the Council has not had an earlier opportunity of expressing an opinion, and having regard to the practice of the Council since the commencement of hostilities to avoid all action tending to delay or in any way embarrass the work of H.M. Government, the Highways Committee consider that the Council should, at the earliest possible date, permit Mr. A. L. C. Fell to serve on the proposed committee. We entirely endorse the views expressed by the Highways Committee, and we recommend :—

"(*a*) That the Council considers that the expert committee set up by the Board of Trade in connection with the management of tramway undertakings should be constituted on a basis securing representation of the municipal and private interests concerned proportionate to their magnitude ; and that it is important that the chairman of such a committee should be entirely free from association with any traffic undertakings likely to be affected, and therefore that the appointment of an interested party as chairman is unfortunate.

"(*b*) That, having regard to the practice of the Council, since the commencement of hostilities, to avoid all action tending to delay or in any way embarrass the work of H.M. Government, and on the understanding that the Council is in no way committed as to its policy, Mr. A. L. C. Fell be permitted to serve upon the expert committee appointed by the Board of Trade in connection with the management of tramway undertakings."

The report and recommendation were agreed to unanimously.

### PROTESTS FROM SCOTLAND.

The Glasgow Corporation Tramways Committee have appointed the convener (Mr. Montgomery) and the conveners of the sub-committees, with powers to take steps, in conjunction with other tramways authorities in Scotland, to impress upon the Board of Trade the necessity for Scotland being represented on the National Tramways Committee.

Direct representation of Scotland was claimed by the Scottish Tramway Officials Association at a meeting held in Stirling on December 6. A resolution was unanimously adopted pointing out that there is no member directly representing Scottish tramway undertakings who is resident in Scotland, and that owing to the large number of munition workers carried on these tramways this would be detrimental to national interests, and urging that Scottish interests should be directly represented. Mr. Dalrymple, of Glasgow, and Major Coutts were appointed as a committee to meet the Board of Trade.

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# THE PROVISION OF TRAMWAY FACILITIES BETWEEN EDINBURGH AND QUEENSFERRY.*

By A. Horsburgh Campbell, M.Inst.C.E.
(*Burgh Engineer*).

The provision of transit facilities between the city and Queensferry is not novel, as the following *résumé* of the earlier essays in this direction will show. In the Parliamentary Session of 1902 a project for a tramway *via* the Dean Bridge was lodged under private auspices, but having failed to receive the necessary consent it was not further pressed. In the Parliamentary Session of 1905 a bill for the promotion, by a company, of a tramway between Comely Bank† and Queensferry engaged a Joint Committee of the Lords and Commons in Edinburgh for three days, at the close of which the Committee decided that the preamble was held "not proved." The opposition to the bill was strong. It was at the instance of two railway companies, the Linlithgow County, and of certain private gentlemen. The promoters showed much zeal and determination, being thoroughly convinced as to the soundness of the proposal from a financial standpoint, but the combined opposition of county and of railways, etc., prevailed against the effort of that date.

Since that Parliamentary effort of 1905 the conditions of the area have undergone much development, favouring and encouraging the provision of transit facilities, commensurate with the needs. If in 1905 the conditions and prospects were good, they are very much better to-day.

The new conditions are :—

(1) The Rosyth Naval Base—not then begun—is now an accomplished fact.
(2) The favourable attitude of the Admiralty towards the Corporation.
(3) The increase of motor traffic.
(4) The near expiration of the cable tramways lease.
(5) The contribution of such a tramway to the city's health and commerce.

Dealing briefly with these five leading changes in the conditions since 1905 :—

(1) This naval base has already brought in its train other engineering works situate and distributed along the shores of the Firth, and these are still upon the increase. Such industrial growth necessarily means an imported population—of a permanent kind—who are already seeking in great part their residence within or upon the confines of the city, and to whom speedy, efficient, and cheap transport is a necessary part of their daily life, and therefore a source of revenue to the city as the tramway undertakers.

But in an even larger sense than the above the importance of the base in its influence upon the industrial, commercial, and social life of the area embraced by this survey cannot be over-estimated, and those benefits will accrue in greatest measure to that community and authority which sets itself sedulously to cultivate quick, frequent, and efficient communication between the "Ferry" and the city.

(2) In the earlier efforts described, the recognition of the Admiralty as a factor in the situation was probably not considered, because it was at those dates too remote, but as evidence of the changed conditions that department has, in their official communication to the Town Council, stated their view of the matter, which may be summed up in the following phrase, "easy and constant communication to Edinburgh cannot but prove beneficial."

This expression of the department gives to the proposal an added value and interest, particularly in its preliminary stages, and may, I think, be considered as ensuring the ultimate—if not, indeed, the immediate—success of the scheme in its financial results. Upon this primal aspect of the question, estimates of capital and operating costs, and the resulting profit or loss have been carefully prepared, and will be presented to the committee at their meeting.

(3) That this means of "easy and constant communication" is in demand now, and is therefore a service of present necessity, is daily evident to even the casual observer, either at the city motor terminus or at Queensferry. Traffic observations taken enable a close approximation to be formed of the number of passengers to and fro on this Queensferry route, and these are of much assistance in the framing of a reliable estimate of the existing traffic as a basis of anticipation of the traffic which will be developed by a tramway guaranteeing a regular, fast, frequent, and cheap service between the city and Queensferry and *vice-versâ*.

Many of the conveyances run "full-up" even to overflow during the busy hours of the day and of evening; further, the service lacks the benefit of, and is unburdened by, those statutory obligations properly imposed by Parliament upon a tramway undertaking operating for the public benefit. The service at those busy times partakes largely of the nature of a "through service," stopping to let down where desired, but having little if any seat margin available to pick up passengers *en route*, and therefore not accommodating efficiently the intermediate population. This is a defect inherent to any motor service on a route which demands for the multitude such constant and cheap transport of a "through" as well as of an intermediate kind.

As the result of a careful study of this question in all its phases, I have formed the opinion that the carrying trade as at present developed is but the nucleus of the trade that is still waiting to be done along this route, for its extent is not to be reckoned by reference only to motor traffic of the "through" or all-the-way kind from the city to Queensferry and *vice-versâ*; there is that "intermediate" business from villages (*en route*), viz., Dalmeny, Cramond, Barnton, Davidson's Mains, and Blackhall, which collectively are of real account and value in their contribution of passengers to a tramway service.

Further, besides motor transport there are the other means of travel to and from Queensferry and neighbourhood, which afford a daily demonstration that the number of travellers or passengers within this area must already aggregate to a large total. But it is not even upon the fixed population that the success of this particular route will depend. It is, in addition, the moving and visiting population, and the traffic they will bring to the tramway. The traffic statistics have been taken at a time when there is an absence of the usual throng of holiday visitors who make the city their resort in peace times. What this traffic will amount to under such normal summer conditions, and with a service adequate, convenient, and cheap, may be more readily imagined than conveyed in figures. But the service will be not for pleasure only (although the attractions of scenery *en route* are in themselves unique); it will be one for business also of an all-the-year-round kind, serving an important national interest and convenience in connection with the base and its subsidiary requirements. From the careful traffic records which have been made for information of the committee it will be apparent how ripe is the field for a tramway, giving cheap and quick service, both of a "through" as well as of an intermediate kind *en route*.

Incidentally, it should be observed that the development of public motor traction has added greatly to the highway costs, and therefore the local burdens in respect of highway maintenance. The extent of the added burden upon the three highway authorities affected, that is, the City, the County of Midlothian, and the County of Linlithgow, is a consideration which must influence the two County Councils in their relation to this proposal, and which particularly affects the city as the highway authority for a distance of 2½ miles of city road traversed by the Queensferry motor vehicles.

(4) This is a coincidence of most opportune kind, avoiding all difficulties or complexities of operation, and dispensing with the need to negotiate with the Corporation's lessees, as in previous tramway extensions.

The Corporation have thus, for the first time in their life as tramway undertakers, a free field for decision, unfettered by any other interest than that of the public. This simplifies the determination of this question; the only uncertain and retarding factor being that of the war. Unless the Government view this project as essential for immediate National Service—and there is much to support this view—its execution must stand deferred until after the war. Meantime in the interval the necessary powers may be sought, as in the recent Corstorphine and Redford Tramways promoted by the Corporation, and authorised by Parliament (May, 1916).

(5) A suburban tramway line, such as that under review, is not to be regarded merely as a medium of transport; it is potent in the facility it opens for the recreation of the people in the wider sense, and the health of the citizens of every class and age. An excursion into and through this picturesque area, possessing such attractions, cannot fail to react beneficially upon the public health. It also promotes the commercial progress of the city in attracting hither for their business and for their residence newcomers to the area of the Forth, who, but for the facilities offered by such a tramway, would tend to go elsewhere than Edinburgh for their residence and their supplies. Further, it will become the link that can unite physically those interests and industries—marine, mining, and engineering—which of necessity are distributed and spread along the southern coast line of the Firth, and the country adjoining, from East to West Lothian.

### City Termini, Routes, System, etc.

A brief description of the suggested termini, also the route, or alternative routes, which are available, is here necessary. In the plans prepared two routes are submitted for consideration; these are—Route No. 1, *via* the Dean Bridge, and, alternatively, Route No. 2, *via* Comely Bank. Both of these routes are governed by one cardinal point essential to the success of the scheme: that is, a through service upon the same car from a convenient centre or terminus in the city to the terminus suggested at Queensferry, that is, the "Hawes" Pier. Any proposal which falls short of this continuity, and which landed the passengers at, say, Comely Bank, and there "Change!" or, alternatively, North of the Dean Bridge, is unthinkable as a practical proposition.

Having this in view, Route No. 1 takes its start from a terminus already authorised for tramway; that is, in Hope Street, thence along Queensferry Street, Dean Bridge, Queensferry Road, Blackhall, Davidson's Mains, Barnton, Cramond, Dalmeny, and onwards to

* A Report presented to the Tramways Committee of Edinburgh Corporation.
† The Dean Bridge route not having received the consent of the Corporation.



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Queensferry. Route No. 2 has its start at the south end of Hanover Street (Hanover Street—opposite the Mound—is preferred to Frederick Street, because the Mound is a recognised traffic centre, which is an asset of value to a tramway), directly opposite the Mound, thence along Hanover Street, Queen Street (north side), and along the cable route to Stockbridge, Comely Bank, and thereafter continuing along the road towards Craigleath Station, whence its course to Queensferry is identical with Route No. 1.

It may be claimed that these two routes, at their city end, are not in reality competitive or alternative, but are complementary to each other; for in any complete system of city tramways, such as will be hereafter developed, both of these routes are natural tramway arteries. Both the termini suggested are good, and each has its own advantage over the other; thus Hope Street, if chosen as the terminus for the time being of Route No. 1, provides the naturally direct and shortest route from the city to Queensferry *via* the Dean Bridge, whilst with Hanover Street (Route No. 2), it is more centrally placed, bringing the Queensferry traffic to a commercial centre already associated with such traffic, and situate midway between the two railway stations.

Dislike of a tramway of whatever form laid across the Dean Bridge as it now is, may be disposed to hastily condemn this Route No. 1 without full regard to all the possible combinations of tramway traction. It is therefore respectfully asked that an open mind may be preserved upon this point until full knowledge is obtained upon these highly technical details.

In a report some time ago submitted by me (upon instruction of a sub-committee) dealing with several outlets from the city to Queensferry, I concluded as follows:—" I am of opinion the straight route (*via* the Dean Bridge) is that to be preferred for a tramway route;" and, further, " I do not consider the Dean Bridge as a suitable place for the putting up of overhead wires." I consider that it may be found not impracticable to operate the tramway service across the bridge without the overhead wires, not because they are in any sense ugly, for they are not; but because here, the valley and the bridge, in their combination, have a character all their own within the city. The bridge is absolutely " open," it has no overhanging foliage as a foil to the wires, and it can never have, it as is elsewhere possible; and for this reason, and considering that its length is very limited, it may be admissible that the æsthetic consideration should here prevail; provided always the alternatives are feasible, and are found to be reasonably economic. But as in any case this event will not accrue for a considerable period, this is a technical detail which may be left over for actual decision at a later date.

Having regard to the advantages which both of these routes possess, it may be thought desirable that in any powers necessary to be obtained from Parliament both may be included in the application, and leave the order of their execution to be decided as and when this eventuates.

From Craigleith to Queensferry these two routes, being along identical lines, are thence treated as one. As such the route may be either (1) partly upon the road and partly on and through the fields—*ex adverso* of the road; or (2) along the road for its entire length.

Dealing briefly with these two alternatives,

(1) *Partly Upon the Road and Partly On and Through the Fields.*—This combination or alternation of road and of field presents much advantage, thereby the road is adopted where the conditions are suitable, and it is avoided where the road is not so suitable and where a field track is available. In the plans submitted these conditions are carefully worked out, so that at certain points the tramway leaves the road, enters the field, and in turn rejoins the road at convenient points where field passage is not reasonably practicable. In this way those lengths of road (although not unfit), such as along the Cramond Bridge and parts westward therefrom—in Linlithgowshire—against which objection might conceivably be taken by the County Council, are mainly avoided. Thereby a large capital sum is saved, and considerably increased speed or rate of car travel is obtained. Convenient and frequent connections with the highway are provided, so that passengers are not lost to the tramway traffic nor inconvenienced in joining or leaving the car.

In the aggregate, the measurements of road tramway and of field tramroad are:—

| | Route No. 1. To Queensferry *via* Dean Bridge. | Route No. 2. To Queensferry *via* Comely Bank. |
|---|---|---|
| Extent of tramway on road | 3 miles | $3\frac{7}{8}$ miles |
| Extent of tramway in fields | 5 ,, | 5 ,, |
| Total ... | 8 miles | $8\frac{5}{8}$ miles |

The saving of time by this combination, as compared with adherence to road all the way, for each single journey, is quite five minutes (probably more), which is the equivalent of a substantial annual economy in operation, quite apart from the saving in capital cost of construction.

There are precedents for this method of tramway formation in Scotland, along kindred routes of open undeveloped country, as, for instance, the Paisley (Rouken Glen route), the Fife Tramways, and the Rothesay Tramways; whilst in England there is the well-known Blackpool-Fleetwood line. Recent town planning developments adopt this form of field or of grassed tram track either along the centre or by the side of highways, as at Liverpool and Southend (Essex), etc; and in the city's own promotion of 1915 for the Braids to Redford line the field track formation in first instance is that proposed to be adopted.

(2) *Upon the Road for the Whole Length.*—This is the more ordinary line or position for a tramway, and has certain advantages, such, as in this case, very slightly shorter, by about 200 yards in the eight-mile length, and it brings the tramcar to the eye of every possible passenger on the road; but these advantages are hardly mentionable when compared with the economy of cost and the higher speed obtainable by the combination before described, and which I beg to advise.

So planned, the approximate time which will be required to cover the journey from City to Queensferry is:—

| Route. | Distance. | Time. |
|---|---|---|
| Hope Street *via* Dean Bridge to Hawes Pier, Queensferry ... ... ... ... | 8 miles ... | 36 min. |
| From Hanover Street *via* Comely Bank, to Hawes Pier, Queensferry ... ... ... | $8\frac{5}{8}$ ,, ... | 41 min. |

Although the route in its western half is undulatory, the gradients are all quite negotiable; the steepest incline being the " Hawes " Brae, equal to 1 in 9 for a short distance of 200 feet. The gradients generally are not exceptional for hilly systems, and need not create anxiety. Dundee, Bradford, Halifax, Huddersfield, Sheffield, and Leeds Tramways have inclines of approximate grade. The system advised for the tramway is the overhead electric, with the possible exception of Dean Bridge, as before described. The gauge of tramway would be, of course, the city's adopted standard of 4 ft. $8\frac{1}{2}$ in., and laid as double line throughout.

The frequency of service would be every ten minutes each way for, say, sixteen hours daily, and a five or seven minutes' service for the city portion; with the added service necessitated by the summer rush, and the possibilities of workmen's car facilities morning and evening. For these two contributions to revenue no credit is taken in my estimate of earnings.

In presenting the estimates of capital cost, allowance for unsettled conditions of the present will be readily conceded, but the committee may feel assured that substantial additions have been made to the estimates over those that would rule in peace time, and they are such as are anticipated may rule for some time post-war. Estimates of revenue and of operating costs have been likewise prepared, and these will be presented at the committee. It will, I think, be found that my estimates err somewhat upon the side of caution, but as to this I would welcome the opinion of a tramway manager should the committee concur in this suggestion. In arriving at my estimates of the probable earnings of the line, I ought to state that I have been much assisted and agreeably surprised by the results of a careful study of the worth and working of certain suburban and rural tramway lines leading out of other towns, such as the following, viz.:—

| Name of Town or System. | Length of Route into Country from Centre of City. | Nature of the Line. | No. of Years in Operation. | Revenue per Car Mile per annum. | Frequency of Service. | Car Mileage per Annum. | *Single* Fare per Journey. |
|---|---|---|---|---|---|---|---|
| Aberdeen ... | 5 miles | Suburban and Rural | 14 | 11·28d. | 24 mins. normally, with increase during week-ends | 70,600 | 3d. for 5 miles, 2d. for 3 miles |
| Dundee, etc. ... | $7\frac{1}{2}$ miles | Suburban and Rural | 11 | 12·17d. to 15·127d. | Average about 15 mins. ... ... | 120,000 to 160,000 | 4d. for 8 miles |
| Paisley ... ... | $7\frac{1}{4}$ miles | Rural... ... | 6 | Well over 1s. | Every $\frac{1}{4}$ to $\frac{1}{2}$ hour, with 5 and 10 mins. intervals in season | 311,000 | 5d. for 7 miles |
| Blackpool-Fleetwood | 8 miles | Inter-urban | 18 | 17·07d. | Average about 9 min. apart; much more frequent in summer; less frequent—about 15 mins.—in winter | 601,906 | 6d. for 8 miles |
| (Suggested) Edinburgh to Queensferry | 8 miles | Suburban and Rural | ... | 1s. (estimated) | 10 mins. from 8 a.m. till 12 midnight. Extra service for workmen. | 700,000 (approximate) | 6d. for 8 miles (suggested) |

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It is upon the experience of these lines, reinforced by my knowledge of the traffic already developed within the area, that my estimates of revenue have been based for this tramway.

Compared, however, with any of these other tramways quoted, the suggested line to Queensferry excels them all in the population fixed and floating which will feed the line, in the natural and varied amenities of the landscape, and in the attractions at both termini, which are without compare anywhere in the kingdom, that is to say, the City of Edinburgh, and all that it means as a centre of attraction at one end; whilst at the other end is Queensferry, with its scope for pleasure-sailing—not yet developed—in the upper waters of the Firth, its Forth Bridge, and now the Base and its accompaniments, concerning which the interest and attraction to citizens and to visitors will not stale with time. These must bring good grist to the mill of that authority fortunate enough to own and to operate the tramway rights over a route so potential in public benefit.

It is those great engineering works of recent creation, with their attendant activities; added to the fine scenery *en route*, which give to this proposal, now revived, exceptional interest and value, to which the city of Edinburgh possesses the first and natural claim.

Although the remit makes no mention of other forms of transit than that of "tramway," I may be permitted to say that I have not excluded from my study of the subject both the possible economy and suitability of the motor-omnibus as a medium of public transport for this route. After much careful study of the comparative costs and the local necessities, I am unable to advise either its relative economy or its suitability for a service of the kind here required. It is not adapted to the necessities and conditions of the situation. My reasons for this conclusion I shall be pleased to give if desired. The motor-omnibus has its appropriate and economic place, but Edinburgh to Queensferry—with the peculiar needs and conditions of these destinations—is not its proper province, publicly considered. This is, in fact, pre-eminently a tramway route.

## THE MOTOR-OMNIBUS AND TRAMCAR COMPARED.

Gentlemen,—I am asked to amplify the reference in my earlier report to the suitability of the motor-omnibus as a possible vehicle of public transit between Edinburgh and Queensferry as compared with a tramcar.

Fundamentally, the comparison may be stated and tested under the following heads, viz.:—

(1) *Accommodation.*—One motor-omnibus (single or double-decked), seats from 28 to 36 persons = average, 32; one tramcar (electrically propelled, single and double decked), seats from 48 to 72 persons = average, 60. The comparison of accommodation is therefore expressible as follows:—Motor-omnibus = 1; tramcar = 2.

(2) *Cost of Operation, Exclusive of Contribution to Capital.*—The cost of operating a motor-omnibus may be stated at from 8·5d. (pre-war), rising to 13·17d. and upwards to 16·81d. per omnibus-mile (current maximum rate) of 32 persons (average).

The cost of operating a tramcar (electrically propelled) may be stated at from 5·90d. to 11·44d. (current maximum rate) per car-mile, of 60 persons (average).

For comparison of the two systems in actual work, upon scales adequate to form a sound opinion, take the following two towns, operating their own electric tramway system, along with motor omnibuses as adjuncts, thus:—

| | Cost per Omnibus Mile. | | Number of Motor Omnibuses in Service. |
|---|---|---|---|
| | Year 1915-16. | Year 1916-17. | |
| Birmingham ... ... | =9·584d. | 11·844d. | 41 and 52 respectively. |
| Sheffield ... .. | =8·355d. | 9·711d. | 22 |
| Average .. | =9·873d. | | |

| | Per Tramcar Mile. | | Number of Tramcars in Service. |
|---|---|---|---|
| Birmingham ... ... | =8·419d. | 10·059d. | 585 |
| Sheffield ... ... | =7·333d. | 8·340d. | 349 |
| Average ... | =8·54d. | | |

Applying the above two cases of Birmingham and Sheffield, which are the only two cities possessing in connection with their municipal tramways the auxiliary of such a substantial fleet of motor-omnibuses, we have the following comparison of operation as between the tramcar and the motor-omnibus respectively, thus:—

At Birmingham.—The motor-omnibus:—Operating costs (1916-1917) = 11·844d., or, say, 1s. per omnibus-mile. The tramcar:—Operating costs (1916-1917) = 10·059d., or, say, 10d. per car-mile.

At Sheffield.—The motor-omnibus:—Operating costs (1916-1917) = 9·711d., or, say, 9¾d. per omnibus-mile. The tramcar:—Operating costs (1916-1917) = 8·34d., or, say, 8⅓d. per car-mile.

From the foregoing it appears that at Birmingham the cost of operating a motor-omnibus (seat for seat) may be stated as 1·87 times that of a tramcar, or approximately twice; and at Sheffield the cost of operating a motor-omnibus (seat for seat) may be stated as 2·12 times that of a tramcar. The average working cost of tramways operation over 35 large towns of the United Kingdom is 7·82d. per car-mile.

(3) *So Much for Operation only. What of Capital Cost and the Annual Repayments towards Capital Redemption?*—This part of the cost must be worked out locally, i.e., with reference to the particular route under consideration—that is, the City to Queensferry—and added to the known costs of working, as elsewhere ascertained. I estimate this head of account upon the Queensferry route will add to the operating or working cost for a tramway = 4·5d. per car-mile. With a motor-omnibus service the contribution towards this head of account will add to the working or operating cost = 1·88d. per omnibus-mile.

The following comparison (reduced to the common standard of tramcar-mile and motor-omnibus-mile respectively) may now be given; and for this purpose the operating cost of tramcar is based upon the average of 35 towns of over 100,000 inhabitants (latest published returns):—

| | Average Operating Cost per Mile. | Annual Contribution towards Capital per Mile of Car or Omnibus respectively. | Total Costs of Operation (including Capital). |
|---|---|---|---|
| TRAMCAR. | | Estimated. | |
| Average of 35 Towns of over 100,000 inhabitants ... | 7·82d. | 3d. | 10·82d. |
| Applied to the Queensferry route (as advised) ... | 6·50d. | 4·50d. | 11·00d. |
| MOTOR-OMNIBUS. | | | |
| Average of latest two years' working ... ... ... | 9·873d.* (actual) | 1·88d. | 11·753d.* |

* To this rate of 11·753d. per omnibus-mile may be added a charge in respect of road maintenance, not at present ascertainable.

Thus, taking the two main heads of account, i.e., capital cost plus operating cost, we have the following comparison reduced to the common standard of total cost per mile of passenger.

Tramcar per mile for, say, 60 persons = 11·00d. = 0·183d. per passenger.

Motor-omnibus per mile for, say, 34 persons = 11·753d. = 0·346d. per passenger.

In other words, the gross cost (exclusive of road maintenance) may be expressed by the following formula:—

Tramcar equals 0·183d. per passenger per car-mile.

Motor-omnibus equals 0·346d. per passenger per omnibus mile. That is to say, the motor-omnibus is in the total of operating and of capital costs combined, approximately 89 per cent. more costly to carry on than the tramcar (seat for seat).

The foregoing facts applied to the Queensferry route and its own peculiar conditions (making due allowance for the variations of load and of passenger distribution) lead me to say that, in order to make a motor-omnibus service yield the same financial results as a tramway service, and providing the same travelling facilities (seat for seat) as the tramcar, the gross income of the motor-omnibus must be from 1·33 to 1·5 times that of the tramcar, being the equivalent of about £12,000 to £15,000 extra revenue per annum to that required for a tramway, and this can be got only by increasing the fare from sixpence to about ninepence per passenger for the single journey, if the same accommodation is to be offered to individual passengers by both services. But this high scale of fares would of itself prevent it from ever becoming a popular ride within the reach of the working classes and their families. The scheme would therefore lose much of its value as a health and pleasure factor; and it would remain a permanently inefficient and not popular service except to those who can afford to pay the much higher fare and endure the relative discomforts of a motor-omnibus as compared with a tramcar. In this form it could not be called a people's service, which is the function of a municipal tramway.

The present scale of fares by the service of motor-omnibuses is tenpence for single journey, as compared with my estimate of sixpence by the tramcar. Besides the loss and deprivation to the citizens by the higher fare suggested, there is, further, the loss accruing to local rates from the absence of any local assessment of a motor-omnibus undertaking except only for depots. Municipally considered, this is an important item in the financial comparison, and its importance will be appreciated when, for illustration, it is stated that the local rates (owners' and occupiers') upon the Edinburgh Cable Tramways amount to about £15,000* per annum. If, therefore, the tramway service were superseded by the motor-

* Current year, £17,000.

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omnibus, the rates would be poorer from this source by that amount annually, less the assessment value on depots.

On the general subject of motor-omnibus versus tramcar there are further points incidental to this comparison to be developed. They barely arise upon the Queensferry route.

But beyond that strictly financial side of the question are the other aspects of (*a*) convenience, (*b*) suitability, (*c*) exclusive rights, etc., whilst of importance to the Corporation is the problem of getting the necessary powers from Parliament for a motor-omnibus undertaking.

(*a*) *Convenience.*—If the motor-omnibus is a double-decker—that is, seated for 34 persons—the relative inconvenience and its inaccessibility (not to mention the reduced safety, and the swaying motion of the motor-omnibus as compared with a tramcar), are obvious, and need no exposition.

If the motor-omnibus is a single-decker seating only 28 to 30, then the disparity of cost is increased against, and is still more unfavourable to, the motor-omnibus, whilst the congestion of the motor-omnibus interior, and its disagreeable atmosphere as compared to a tramcar, are likewise acknowledged.

It must be remembered that, for the greater part of the year, only the enclosed type of omnibus would be suitable.

(*b*) *Suitability.*—As applied to such a route as Queensferry, with its sudden and probably frequent demands for the transport of bodies of men from the Fleet, and of civilian passengers during the holidays and the summer rush traffic, the only suitable public service vehicle for this route is the tramcar, with its much greater accommodation, its remarkable adaptability to such sudden demands, and its greatly reduced cost of operation (seat for seat).

(*c*) *Exclusive Rights.*—Assuming a municipal motor-omnibus service here as possible, it is most improbable that there could now be any exclusive rights granted to the Corporation in respect of this route. With a tramway, the possibility of any other body or authority acquiring concurrent powers from Parliament for tramway rights along the same route is, I believe, without precedent.

*Concluding Observations.*—The fact that a great service of motor-omnibuses operates through the City of London offers no analogy and provides no reason for anticipation of financial success on such a route as Edinburgh to Queensferry, except at the much increased fare, beyond that of a tramcar. Thoughtful reflection of the entirely dissimilar conditions of London and of Queensferry will readily suggest why the success presumably achieved in London is no criterion to success on the Queensferry route, but upon the contrary.

It is a fact that the profits of any tramway system depend in great part upon the revenue obtained from the comparatively few hours daily of peak-load. This, stated broadly, and applied to the Queensferry route, means that during these hours a tramcar (64 passengers) would, at the proposed rate of 6d. for the journey of 8 miles, be earning about 4s. per car-mile, while the total cost of operation would be, say, 1s. per car-mile, leaving a difference of 3s. per car-mile as surplus to help for the quiet hours; and a motor-omnibus (32 passengers) would be earning about 2s. per omnibus-mile, while the total cost of operation would be, say, 1s. per omnibus-mile, leaving a difference of only 1s. per omnibus-mile as surplus to help for the quiet hours.

Or, in other words, the tramcar, operating at less cost, is capable of earning a revenue twice that of the motor-omnibus, and a balance or surplus, after meeting all costs and expenses, of thrice that of the motor-omnibus, the rate or scale of fares being assumed as equal in both cases, and seat-for-seat in each case.

In conclusion, I repeat what I have before stated:—"The motor-omnibus has its appropriate and economic place, but Edinburgh to Queensferry—with the peculiar needs and conditions of these destinations—is not its proper province, publicly considered."

APPENDIX.

Since preparing the foregoing report, I have received from Birmingham and Sheffield the following summarised statement, which puts clearly the actual working comparison between the two systems of tramcar and of motor-omnibus respectively. Year under review, 1916-17:—

(1) BIRMINGHAM.—Average fare paid per passenger per tramcar mile = 0·6d., or three-fifths of a penny. Average fare paid per passenger per omnibus-mile = one penny.

(2) SHEFFIELD.—Average fare paid per passenger (by tramcar) = 0·876d., or seven-eighths of a penny. Average fare paid per passenger (by motor-omnibus) = 1·606d., or 1 3-5ths of a penny.

These figures of the most up-to-date records available, from two such cities as Birmingham and Sheffield, show that in the case of Birmingham the motor-omnibus requires an average fare per passenger of 66 per cent. higher than a tramcar, whilst in Sheffield the motor-omnibus requires an average fare per passenger of 83 per cent. higher than a tramcar.

The fare charged per mile in Sheffield makes the comparison still more significant:—Thus, with a tramcar the average fare charged per mile is only = 0·371d., or three-eighths of a penny, whilst with a motor-omnibus the average fare charged per mile is = 1·218d., or 1¼d.; being a difference per passenger of = 0·847d., or about seven-eighths of a penny per mile.

That is to say, the average fare charged on the motor-omnibus for like distances is 2¼ times higher than that charged for the tramcar.

NOTE.—In considering these comparative results of the two systems, allowance should be made for the greater preponderance of tramcars over the number of motor-omnibuses.

EASTBOURNE, which is served solely by motor-omnibuses, supplies the following statistics of their operation, viz.:—

TOTAL COST PER OMNIBUS-MILE (including capital contribution).

| | | | |
|---|---|---|---|
| Year = 1914-15, | 12·02d., | whereof for capital repayments | = 1·69d. |
| ,, = 1915-16, | 12·61d., | ,, ,, | = 0·74d. |
| ,, = 1916-17, | 20·13d., | ,, ,, | = 3·32d. |

These figures, quoted from Eastbourne, Sheffield, and Birmingham reports, more than confirm the conclusions stated in the foregoing memorandum as to the incomparable economy of the tramcar over the motor-omnibus, as a vehicle of transit for city and for suburban service such as that now under review in relation to Queensferry.

## A JOINT REPORT UPON THE PROPOSED INSTALLATION OF TRAMWAYS BETWEEN THE CITY OF EDINBURGH AND SOUTH QUEENSFERRY.

By J. B. HAMILTON (*General Manager, Leeds City Tramways*)
and
E. P. FISHER (*General Manager, Dundee Corporation Tramways*).

In pursuance of communications received we have recently visited Edinburgh, and gone carefully over the proposed route. We are both extremely well acquainted with the topography of the district, and are fully cognisant of the traffic possibilities which exist or may be created as a result of the proposed form of transport. In connection with both cities to which we are officially attached schemes for the suburban extension of tramways have from time to time been dealt with, and it has been our duty to report upon all matters relating thereto. In several cases such extensions have been carried into effect with the most satisfactory results, both as to the travelling public and the financial returns. In addition, we have both been asked to advise in the case of other localities where the proposed scheme was analogous to that which is now under consideration.

The general policy of a Corporation to extend their transport facilities, when satisfied there is public necessity, from the city into surrounding districts, has received the full approval and commendation of Parliament in innumerable cases—in fact, we do not remember an instance in which the Corporation, being satisfied themselves as to the advantages of the proposal, and not being opposed on the preamble by the local authorities into whose area they proposed to extend their system, have been refused the necessary Parliamentary sanction. The promotion of such lines has very frequently been opposed by railway companies, generally on the ground of competition, but they have invariably been unsuccessful in sustaining their petitions.

In our view the present seems an exceptionally opportune time for such an application being made to Parliament. The high pressure at which everyone is working during the present national crisis will undoubtedly to some extent be relaxed when hostilities cease, and the opportunities which this line will afford of economical and frequent communication between the City of Edinburgh and the beautiful and interesting district around Queensferry will, if then constructed, be eagerly utilised by the residents in Edinburgh and the districts to be served, as well as their numerous visitors.

It is probable that for such reasons, and in view of developments which may ensue during the reconstruction period after the war, Parliament, which during 1915-16 had indicated a disinclination to consider private Bills unless of a most urgent nature, have considered and granted during the session of 1917 a permission to several local authorities to instal forms of transport, and have also dealt with other forms of local legislation. If the sanction is given by Parliament, it would be practically a year before construction would be commenced, and in any case nothing could be done until the consent of the Treasury had been received for the borrowing of the necessary capital.

Further delay would, in our view, be almost certain (having regard to the traffic possibilities) to encourage private enterprise to promote schemes for tramways upon this most favourable route. In our opinion it should be the settled policy of the city to control not only all the tramways within the boundaries, but also on such main arteries of travel as the Queensferry route. Such is the decision arrived at in practically every town and city within the Empire.

As the general features of the route must be known to all the members of the Tramways Committee, we need not further enumerate them, except to point out that there are practically no engineering difficulties whatever. Apart from questions of amenity, the Dean Bridge is even wider than in many cases in which tramways are now being successfully and safely operated. Again, the gradients of Hawes Brae are less severe than exist on many undertakings, and are well within a reasonable factor of safety.

We have duly considered the proposal to construct lines so as to enter or leave the city by Dean Bridge or Comely Bank, and recommend that both routes should be included in the application. We suggest that they are complementary to each other, and have definite traffic possibilities which justify them. The proposal to construct

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partly on the roadway and partly on adjacent private ground is an excellent and most desirable one, as it provides a guarantee for the lessening of the cost of installation and operation, and at the same time, by increasing the effective speed, adds a great attraction to the travelling public. We have gone over very carefully the estimates for construction prepared by the city engineer, and consider they are more than ample, notwithstanding the increased cost of materials and labour, to cover all costs of construction which it is reasonable to forecast.

The magnificent situation of the City of Edinburgh, with its historical associations and buildings, must at all times attract large numbers of visitors; in addition to that the world-famous Forth Bridge, the presence of large numbers of the units of our Fleet, which never fails to stir the public imagination and interest, and the beautiful and varied panorama of scenery between Edinburgh and South Queensferry, entitle the trained observer of tramway problems to assume that, in addition to the residents in the city and *en route* to Queensferry, there will be a very large influx of people from all parts of the kingdom.

We have gone very carefully into the figures of resident population supplied to us, and in addition have taken account to a justifiable extent of the transport possibilities, of members of our Fleet, and of visitors. From these figures, applied with the knowledge gained by a wide experience, we have prepared approximate estimates of revenue and working expenses, as well as sums required for the payment of interest and sinking fund, and in consequence beg to state, on financial grounds, that the Tramways Committee need have no hesitation in recommending to the Council the construction of this line, considered either as a portion of, or a separate entity from, the general system of tramways.

It will not only, in our view, be entirely self-supporting, but when in due course the whole system of tramways passes into the hands of the Corporation it will, in all similar circumstances, be a considerable augmentation to the tramway revenue. We are conversant with other occasional forms of road transport, such as motor-omnibuses, railless traction, and so on. Except by those who have never gone thoroughly or impartially into necessary details of relative costs, or fairly considered the elasticity of travelling accommodation which the larger, more reliable, more sanitary and comfortable tramway-car provides, as compared to a motor-omnibus, there can be no case seriously put forward of challenging the decision of the responsible authority to instal the well-tried and proven form of traction by overhead electric tramways, which we unhesitatingly recommend to be adopted as best suited for the traffic requirements we anticipate will be experienced between Edinburgh and South Queensferry.

## FINANCIAL REPORTS AND MEETINGS.

**United Electric Tramways of Caracas, Limited.**—A dividend of 7 per cent., less income-tax, for the last financial year has been declared.

**John Brown and Company,** of Sheffield, have declared an interim dividend at the rate of 5 per cent. on the ordinary shares, less income-tax.

**British Electric Traction Company.**—The board announce a dividend at the rate of 6 per cent. per annum on the preference stock for the half-year ended September 30.

**The Electric Construction Company** have declared a dividend at the rate of 6 per cent. per annum on the ordinary shares, less income-tax, for the year ended March 31, 1917.

**Cape Electric Tramways.**—After providing the debenture interest and redemption, there is a net credit balance of £39,152, as compared with £23,680 for the previous twelve months. The amount carried to reserve has been increased from £5,000 to £12,000, and the ordinary dividend has been raised from 3¾ to 5 per cent., and £2,597 is carried forward. During the year the tramways carried 23,752,016 passengers, earning £231,105, as against 22,477,366 passengers, earning £212,791, in 1915-16. A satisfactory increase on the preceding year is shown both as regards the Cape Town and Port Elizabeth systems, which is attributable to the number of troops from Australia and New Zealand who have passed through Cape Town and to the general prosperity throughout South Africa.

**Record Year at Ayr.**—Mr. W. Grant, general manager of the Corporation Tramways, reports that for the year ended May 15 last the total revenue amounted to £21,074, compared with £19,285, showing an increase of £1,789. The traffic receipts alone constitute a record, amounting to £19,756, against £18,377, an increase of £1,379. The receipts per car-mile work out at 11·79d., as against 9·62d. The number of passengers was 4,596,906, compared with 4,352,113, an increase of 244,793. The number of miles run was 428,739, as against 457,503, a decrease of 28,764. This is accounted for by the fact that the winter service was continued throughout the summer, only occasional extra cars being run as required. The working expenses, exclusive of power charges, amount to £9,609, or 5·37d. per car-mile, and, including power costs, the total working expenses for the year amount to £12,842, or 7·18 per car-mile. This shows a percentage of working expenses to receipts of 60 per cent., The charge for energy supplied to the tramways was increased by 10 per cent., making a total increase of 25 per cent. since 1915.

**Norwich Tramways Company.**—The annual report, presented at the shareholders' meeting, showed receipts totalling £43,712 17s., increase £880 2s. 6d., and expenditure £30,827 9s., increase £1,318 16s., making net profit £12,885 8s., decrease £438 13s. To the sum of £12,885 8s. must be added £428 10s. brought forward, making a total of £13,313 18s. to be dealt with as follows:—£8,000 reserve fund, £5,280 to payment of 2 per cent. dividend on the shares for the year ended June 30, and £33 18s. to be carried forward. The number of car-miles run was 963,484, against 932,934, passengers 10,767,626 (10,405,881), earnings per mile 11·61d. (11·02d.), expenses per car-mile 7·49d. (6·91d.), earnings per passenger 0·97d. (0·99d.). In moving the adoption of the report, Mr. F. Fitzgerald (who presided) stated that after paying a dividend of 3 per cent. for five years, the directors were obliged to propose to return to 2 per cent., as a serious necessity had arisen of adding to the reserve in view of the reconstruction work that must be undertaken as soon as circumstances permitted. The general rate of fares in operation was less than that authorised, and in view of the strain on the company's resources it was felt that this was the proper time to place all passengers on an equal footing, with the exception of scholars.

**Newcastle Tramways Successful Year.**—The annual report of the engineer and general manager (Mr. Ernest Hatton) of the Newcastle Corporation Tramways and Electricity Department for the year ended March 31, 1917, shows that the traffic revenue for the year was £346,334, as compared with £314,732 for the previous year, while the total revenue amounted to £356,534, as compared with £324,694. Working expenses aggregated £208,299, the balance of profit being £148,235. Adding interest on investments, £6,383, there is a total of £154,619, as compared with £135,764 in the previous year. After payment of interest, sinking fund, and other charges, there is a balance of £62,902, as compared with £44,858. It is proposed to appropriate the balance as follows:—Income-tax, £15,845; contribution in aid of rates, £7,000; insurance reserve, £2,065; and renewals fund, £37,992. The passengers carried numbered 78,189,246, an increase of 5,437,615 over 1915-16, and over 13 millions above that of 1914-15. Traffic expenses are £24,000 higher than in 1914-15. The only reduction in expenditure is that for local rates, which followed the extended negotiations and litigation with the Poor Law authorities, and resulted in an approximate reduction of £8,000. The City Council have decided to make a contribution to the rates from the tramway revenue of £7,000. The tramway manager refers to the growing demand for increased services of cars for workmen, and says that while every effort has been made to cope with this demand, in view of the limitations placed on the system by the Government departments, it is impossible to do much more. As showing the efforts that have been made to meet the requirements of the workpeople, it is stated that 380 car loads, averaging 100 passengers per car, have been dealt with daily.

**Auckland Electric Tramways.**—Presiding at the meeting of the Auckland Electric Tramways Company, Limited, on November 20, Mr. C. G. Tegetmeier, the chairman, said that the main features of the year ended June 30 last were the substantial increase in receipts, and the almost equal increase in working expenses. The traffic receipts amounted to £282,697, which was £7,914 more than in the preceding year, and was the highest amount yet taken. There was a corresponding increase in the number of passengers carried, which reached a total of 43,351,000, or nearly 1,000,000 more than in the preceding year. Fortunately the increase of £15,000 in traffic receipts during the past two years had been sufficient to make up for the increase in expenses. They might anticipate with confidence a further development of traffic. Considerable difficulties had been met with in regard to the supply of materials and the shortage of suitable labour. During the year 34 of their employees had left for military service, making a total of 121 since the beginning of the war. The strike of coal miners in New Zealand in April last affected the supply of fuel and interfered with their services, but the total car-mileage showed a slight increase. Under the New Zealand laws the income-tax is leviable on the companies and not on the individual shareholders in the company. As a consequence the whole of the profits are subject to income-tax on a higher scale. As the company are serving a public need, and with statutory limitations upon the price they can demand from the public for their services, the New Zealand laws press upon their shareholders somewhat unfairly. In New Zealand a similar enterprise, if carried out by a municipality, would be entirely exempt from taxation. During the year they had, at the request of the City Council, constructed a line about half a mile in length connecting different parts of the system in the centre of the city. It had been an expensive line to construct, but it would facilitate the handling of the traffic. The net result of the year's working was that after providing for all revenue charges, and setting aside £25,000 for renewals and depreciation, they had a net profit of £55,317, or £746 more than in the preceding year. They proposed to make the same allocation as in the preceding year, namely, £10,000 to reserve and £35,625 in payment of a dividend of 1s. 7d. per share for the year on the ordinary shares. The reserves which had been established and added to on this occasion, including the carry-forward, amounted to £203,518, which was more than 20 per cent. of the total paid-up share and debenture capital.

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## PERSONAL.

**Councillor W. Evans, J.P.,** the new mayor of Newport, has been a member of the Tramways Committee.

**Mr. Harrison Barrow** has been re-elected chairman of the Birmingham Corporation Tramways Committee for the eleventh time.

**Mr. E. J. Elford,** borough engineer of Southend-on-Sea, has been appointed city engineer of Cardiff, at a salary of £1,000 per annum.

**The Right Hon. Lord Carmichael, G.C.I.E., K.C.M.G.,** has accepted a seat on the board of the British Thomson-Houston Company, Limited.

**Mr. H. Faraday Proctor** on November 9 completed the twenty-fifth year of his service as engineer and general manager of the Bristol Corporation electricity department.

**Mr. A. R. Fearnley,** general manager of Sheffield Corporation tramways and motor department, whose present salary is £1,000, has been granted two annual increments of £100 each.

**Mr. W. H. Stradling** has been appointed assistant manager of the Bristol Tramways and Carriage Company, Limited, in the continued absence on active service of Lieut.-Colonel S. E. Smith.

**Mr. H. R. F. Mackay,** city electrical engineer of Sydney, is visiting the United States and Canada, and in the course of his visits will inspect the principal electric supply undertakings in America.

**Mr. C. H. Wordingham,** president of the Institution of Electrical Engineers, has accepted office as one of the vice-presidents of the British Electrical and Allied Manufacturers' Association (Incorporated).

**Alderman R. A. Smithson** has been re-elected chairman of the Leeds Corporation Tramways Committee. With a brief intermission, Alderman Smithson has been chairman of the committee since 1898.

**Lieut. E. Evans, R.G.A.,** has been appointed road transport officer under the Ministry of Food for South Wales and Monmouth. His duties are to carry out a scheme for the saving of both mechanical and horse transport.

**Mr. W. A. Toppin** has been appointed assistant electrical engineer at Chesterfield Corporation electricity works at a commencing salary of £250. Mr. Toppin has been testing and commercial assistant at Greenock.

**Mr. E. L. Morgan** has regretfully declined the position of city engineer of Cardiff, to which he was recently appointed. This decision has been taken owing to advice that the climate would be unfavourable to his wife's health.

**Mr. C. W. Mallins,** general manager of Liverpool Corporation Tramways, has, we regret to learn, sustained an injury to his knee by falling on the pavement owing to the lack of light. The injury is not serious, and he has been able to attend at his office.

**Mr. W. Craufurd** and **Mr. E. T. Holt,** engineering assistants in the tramways department of the London County Council, have been appointed assistant permanent way engineers at a commencing salary of £325, increasing by £25 annually to £400 a year.

**Mr. Stanley Saunders,** chief clerk in the electricity department at Lincoln, is taking up a similar post at Salford. Mr. Stanley Clegg, electrical engineer, on behalf of the staff of the electricity and tramways department, has presented him with a watch.

**Mr. R. J. West** has been appointed to fill the vacancy on the board of Norwich Tramways Company caused by the death of the Hon. A. G. Brand, whose loss was reported with regret by the directors at the annual meeting. **Mr. F. Fitzgerald** was re-elected chairman.

**Mr. J. E. Dobson,** late Scottish representative of Bruce Pebbles and Company, Limited, Edinburgh, has been appointed London office manager to the company in place of the late Mr. R. W. Gauntlett, and has taken up his new duties at Hastings House, Norfolk Street, Strand.

**Lieutenant H. M. Dawson,** on resigning his membership of Bingley Urban Council because of his election to Bradford Corporation, was referred to as "a man who did things," in proof of which statement the great part he took in bringing the Bradford Tramways to Bingley was mentioned.

**Mr. Hy. Clayton** has been appointed assistant engineer and manager of the Preston Corporation Tramways at a salary of £200. He has been in the employment of the Corporation for about twelve years, and, it was stated, had proved himself to be an excellent officer and a good all-round engineer.

**Alderman Russell Taylor** has been re-elected chairman of Liverpool Tramways Committee, and **Alderman Fred Smith** deputy chairman. In returning thanks, the chairman referred to the want of consideration shown by passengers towards the women conductors, who were doing their work wonderfully well.

**Mr. Fred Bland,** of Edgar Allen and Company, Limited, Sheffield, on November 10 gave an illustrated lecture on "Thirty Years' Tramway Practice" to the members of the Rotherham Technical Institute Engineering Society. He described the process of manufacture of a tramway point and the evolution of points and crossings.

**Mr. Chalmers Kearney** will lecture on "High Speed Railways After the War" before the Society of Engineers on Monday, December 17, at 5 p.m., at the Geological Institute, Burlington House, Piccadilly, W. Tickets may be obtained on application to the Secretary, Society of Engineers, 17, Victoria Street, London, S.W.1.

**Sir John Courtis,** chairman of Cardiff Tramways Committee and Development Committee, is interested in a new industry which is about to be started in that city. According to an announcement at the Lord Mayor's election, the industry will be of a new character, and will involve the employment of many women and also operatives in subsidiary trades.

**Mr. John C. Mitchell, F.C.I.S.,** was appointed at the meeting of the Lambeth Borough Council held on Thursday, November 22, as the Council's representative on the Metropolitan Water Board. Councillor Mitchell is treasurer of the Underground Electric Railways Company of London, Limited, and allied companies, and has recently served as president of the Chartered Institute of Secretaries.

**Mr. R. H. Dickinson,** chief engineer of the Birmingham Corporation Tramways, has received official intimation that his eldest son, the Rev. H. Dickinson, vicar of St. Stephen's, Birmingham, was killed in action on October 30, while acting as chaplain to the Artists Rifles. Imbued with a strong sense of devotion to duty, he volunteered for service at the front, and was appointed chaplain to the General Headquarters.

**Mr. F. W. Ketley,** manager and engineer of Norwich Tramways Company, was warmly praised by Mr. F. Fitzgerald, who presided at the annual meeting. The chairman's remarks were supported by the Lord Mayor of Norwich, who said that Mr. Ketley performed his duties admirably, and had ingratiated himself with the citizens by his readiness to help in any work. The staff and employees were also commended by the chairman.

**Mr. T. R. Whitehead,** engineer and manager of Coventry Corporation Tramways, has been granted an increase of salary from £600 to £700 per annum. Councillor Wale, chairman of the Tramways Committee, in recommending the increase to the Council, said that it was the unanimous recommendation of the members of the committee, and alluded to the able services rendered by Mr. Whitehead in times of great difficulty.

**Mr. Arthur Brown,** city engineer of Nottingham, on November 21 completed fifty years' association with the Corporation. *The Nottingham Guardian,* in an appreciative notice of Mr. Brown's services, says that he has had a potent influence in the development of the city. To mark the completion of his fifty years' work, the staff and employees of the engineering department have presented him with an address and a beautiful silver inkstand.

**Councillor George New, J.P.,** chairman of Sunderland Tramways Committee, has been appointed an alderman. Like the late Councillor T. Summerbell, M.P., whom he succeeded in the chairmanship eleven years ago, he is a member of the Labour Party. He has served on the Education, Watch, Health, Lighting, and other Committees, but his principal work (says the *Sunderland Daily Echo*) has been in connection with the tramways. He took a prominent part in the propaganda which resulted in the decision to municipalise the service, and when the Tramways Committee was formed he was elected a member. It is acknowledged by all who are conversant with the work he has done as chairman that he has been eminently successful.

**Mr. J. B. Hamilton,** general manager of the Leeds City Tramways, reported to the committee on November 20 that he had been nominated by the Municipal Tramways Association to join the committee which is being set up by the Board of Trade to co-ordinate supplies, and thus economise the services of the tramways of the country. He was given a free hand in regard to the acceptance of the position. For some time past Mr. Hamilton has filled a responsible post at the Admiralty in connection with the arrangement of labour difficulties, a work which is now on a well-organised basis. It is understood that the acceptance of the new post will involve his retirement from Admiralty work. Mr. Hamilton was recently appointed chairman of the Executive Council of the Municipal Tramways Association for the ensuing year. The appointment has been made under the new clause in the articles of association adopted at the conference at Blackpool, which enables the executive to appoint a chairman to preside at all meetings at which he may be present.

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The death occurred on November 4 of **Mr. William Du Bois Duddell,** of 56, Victoria Street, Westminster. Mr. Duddell, who was only 45 years of age, was president of the Institution of Electrical Engineers in 1913. He has recently been a member of the Admiralty Board of Invention and Research, and also of the Inventions Board of the Ministry of Munitions. In August last he was appointed a Commander of the Order of the British Empire.

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**London Underground Traffic Facilities.**—Mr. Wardle, replying to a question by Major Newman in the House of Commons on November 28, said he understood that the services on the London underground railways had not been reduced, but on the contrary had been substantially increased during the war. He regretted that it was not possible at the moment to increase the supply of petrol for omnibuses.

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# TRAMWAY AND LIGHT RAILWAY NOTES.

## AYR.

EMPLOYMENT OF WOMEN DRIVERS.

The annual report of the manager of Ayr Corporation Tramways states that the number of accidents was 22, as compared with 16 the previous year. This is very gratifying in view of the lighting restrictions, and that the majority of the drivers were females. These were factors calculated to increase the risks of accidents, but none of the accidents could be attributed to either cause. The female drivers have done extremely well, and upon three occasions have averted accidents by their coolness and promptitude. The consumption of electrical energy showed a decrease of 3,816 units, but in view of the decrease of 28,764 in the number of car miles the consumption should have been considerably lower. The upward tendency can only be accounted for by the introduction of the female drivers, the necessary training required, and the first complete year's working of the top covered cars. The consumption was equal to 1·08 units per car mile, as against 1·02 for the previous year.

## BARROW-IN-FURNESS.

DANGER FROM LOOSE TROLLEY ROPE.

A ten-year-old girl standing on the top of a Barrow-in-Furness car was struck by the trolley rope, which swung round and caught about her neck, lifting her off the car. She fell into the roadway and was badly bruised.

## BIRMINGHAM.

NO CHRISTMAS TRAFFIC.

In view of the war conditions, and after considering a letter from the Amalgamated Society of Tramway and Vehicle Workers, the Birmingham Tramways Committee have decided that no tramcars or omnibuses shall be run on Christmas Day.

## BURNLEY.

LATE CAR FOR SOLDIERS ON LEAVE.

By arrangement between Burnley, Colne, and Nelson Councils, a tramcar now conveys soldiers to the Colne and Nelson districts who arrive by the last train at Burnley at 11.23 p.m.; civilians are also carried. The car starts from the centre of Burnley, and waits opposite the station until the train arrives, no matter how late it is. Mr. Henry Mozley, the general manager, has made arrangements with the station authorities to let soldiers know what course to take in order to catch the car.

## DUNDEE.

PROPOSED SALE OF RAILLESS CARS.

The deputy chairman of Halifax Tramways Committee, the traffic manager, and the tramways engineer, have been authorised to visit Dundee to inspect two railless trolley cars which the committee propose to purchase. Dundee Tramways Committee discontinued the railless trolley service some years ago, in consequence of the Corporation refusing to sanction a scheme for resurfacing the roadway used by the cars.

## EDINBURGH.

EDINBURGH-QUEENSFERRY TRAMWAY PROJECT.

At the next meeting of Edinburgh Corporation the Tramways Committee will be asked to open negotiations with the owners of land on the route of the proposed tramway to South Queensferry to ascertain on what terms they would supply the land required for the track to be laid or for any roads that might be required, and also to negotiate with the county authorities in regard to roads and bridges on the route, and to report to the Council not later than the first meeting in January.

## GLASGOW.

WOMEN'S WAGES—DAMAGES AWARDED A PASSENGER.

In submitting to Glasgow Tramways Committee the award of the arbitrator on applications for increased pay, the Town Clerk stated that the pre-war remuneration of men had been increased by 15s. per week (7s. wages and 8s. war bonus), the various grades receiving increases varying from 2s. to 7s. Female employees would receive no advance, as they had already 8s. per week more in the tramway service than they would have in a munition factory. The arbiter was of opinion that the principle to be applied to female workers was that expressed in the orders of the Minister of Munitions.—In an action against Glasgow Corporation for £250 damages in respect of personal injuries sustained by Mrs. Mitchell, it was stated that when she was about to alight from a tramcar at a stopping place, the car suddenly started, and she was thrown down. The defence was that pursuer was injured as the result of leaving the car while it was in motion. Lord Ormidale granted decree for £80 and expenses.

## HULL.

ADVANCE IN WAGES—CRITICAL POSITION AS REGARDS POWER PLANT.

Hull Tramways Committee have granted an additional bonus of 5s. 6d., bringing their increase up to 12s. The advance to women is 3s., making their total bonus 7s. These increases involve a yearly expenditure of £7,500, and the chairman has stated that it will bring the undertaking to the border line of profit and loss.—The city engineer reported to the Tramways Committee on November 28 that the tramway's power plant required repairs and renewals, and that any failure in the supply within the next few days would involve a reduction of the service. To his surprise the Ministry of Munitions had refused to sanction the supply of a spare armature, which Siemens Brothers had offered at £1,310. On the suggestion of Councillor Raine, deputy chairman, the committee decided to meet specially to consider the situation, including the question of obtaining part of the supply of energy from the Electricity Committee. For some time a scheme for combining the two power stations has been under consideration, owing to the age of the tramway station and the need for modernising it.

## LEEDS.

CONDUCTORS' UNIFORMS.

Leeds Tramways Committee have forbidden the wearing of regimental badges on the caps of conductors. The caps already bear the city coat of arms, and it appears that women conductors have adopted the custom of pinning various regimental badges on the caps. The practice had become so frequent that the committee found it desirable to pass the rule forbidding it.

## LONDON.

APPOINTMENT OF ASSISTANT PERMANENT WAY ENGINEERS—CAR LIGHTING—INCONVENIENCE OF DEAD ENDS.

On February 20, 1917, the Council decided that in the reorganisation of the tramways department, the salary to be assigned to each of the two positions of assistant permanent way engineer should be £300 a year, increasing by annual increments of £25 to £400. Mr. W. Craufurd and Mr. E. T. Holt, assistants in the first class, have acted as assistant permanent way engineers since 1906, and they now receive £300 a year. The Highways Committee reported that they were well suited for the positions with the designation of assistant permanent way engineer, and the Council appointed them to these positions.—The lamps in the upper decks of tramcars in London have now been partly painted over, after having been entirely unobscured during the greater part of this year. The obscuration, however, is not so drastic as was formerly the case. This year, when notifications of raids have been received, the cars have run in total darkness save for the two headlights and the rear red light.—The disorderly scenes that take place at the terminus of the London County Council tramways at Victoria are causing complaint. It has been suggested that much of the trouble would be avoided if the dead end were converted into a loop, and it was stated at a meeting of the London County Council that a scheme for this purpose was being considered.

## MANCHESTER.

REDUCTION IN LENGTH OF PENNY FARE.

The Manchester Tramways Committee recently decided to recommend the Council to shorten the penny stages on the various routes by 620 yards, with the object of enabling the committee to provide £100,000 in relief of the city rates. Originally the committee proposed that their contribution should be £50,000 for the year, but the Council insisted that the former contribution should be maintained. The recommendation was accepted by the Council on December 5.

## MORECAMBE.

CONVERSION AND EXTENSION.

Alderman William Wright, in returning thanks for his election as mayor, mentioned that one of the necessary improvements was the adoption of mechanical traction on the tramways, which it was desirable should be extended beyond the borough boundaries.

## NEWPORT.

THE TRAMWAYS EXTENDED TO THE DOCKS.

At the end of November Mr. Nicholls Moore, borough electrical and permanent way engineer, completed the extension of the tramways to the docks, where new works have recently been erected. The extension of the tramways became imperative because of the large number of workpeople employed at a factory, which is of a special character. For that reason facilities were afforded for obtaining the Light Railway Order and for securing the necessary tramway materials and labour, although prior to the war railway opposition had prevented the extension being made. About one hundred men were employed on the work of construction. The lines cross the railway at the Great Western and Tredegar level crossings. The additional labour supply has been taken advantage of to effect reconstruction and repair of the tramways at one or two places, so far as the supply of materials allowed. The double-deck cars purchased from the London County Council have been refitted for running on the new line from Clarence Place to the docks.

## OLDHAM.

COMPLAINTS AGAINST EMPLOYEES.

Replying to allegations against drivers and conductors, the employees' union at Oldham has informed Oldham Tramways Committee that they think such complaints should be made to the union officials in the first instance. Regarding a case in which a driver is alleged to have left his car after being spoken to for failing to stop, they, in effect, refuse to believe that such incident occurred. The chairman (Councillor Cheetham) said he got letters of complaint every week. A driver recently was seen to ignore not only a compulsory stop, but a clocking station. When spoken to he left the car. The manager intimated that the driver was instantly

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dismissed, and the committee decided to forward particulars to the association.

### PAISLEY.

TRAMWAYS WAR SERVICE.

The work of the Paisley Tramways Company in providing transport for munition workers has received recognition not only from military tribunals, but from the Ministry of Munitions. Mr. F. Coutts, the general manager, and his staff, have made every endeavour to provide the fullest possible service. For four hours in the morning, starting from 4.30, cars are run exclusively for persons engaged in munition works and controlled establishments, and several hours are devoted to the same workers in the afternoon and evening. At least 70 per cent. of the passengers carried daily are munition workers.

### PORTSMOUTH.

LOADING PLATFORMS FOR PASSENGERS.

An improvement that will add to the efficient working of the Cosham Junction route of Portsmouth Corporation Tramways, and to the convenience and comfort of passengers, will shortly be carried out. Land is to be acquired with a frontage to London Road of approximately 252 feet, and a depth adjoining the railway of 190 feet, upon which side lines will be constructed to avoid congestion of traffic, and at the same time facilitate the loading and unloading of the cars. A sum of £800 has been paid for the land. Councillor J. Timpson, chairman of the Tramways Committee, at a recent meeting of the Corporation, stated that it was proposed to construct a circular line for the cars to run in on, and there would be platforms on a level with the steps of the cars. Passengers will alight on one side, and the cars will then run round and pick up on the other side. A covered gangway will connect the platforms with the public footpath.

### SOUTH SHIELDS.

DAMAGES AGAINST CORPORATION.

On November 9, a Newcastle Assize jury awarded £600 to a wagoner who brought an action against South Shields Corporation for damages for personal injuries, alleged to have been caused through the negligence of a tramcar driver. Plaintiff, it was stated, was going down Station Bank with a four-wheeled wagon. He was walking on the pavement holding the reins to steady the horse, when a car coming behind ran into him. He was pulled underneath the wagon and injured. The Corporation had paid £150 into Court, and applied for a stay of execution, having regard to the amount of damages. The Judge, in granting the application, remarked that by doing so he did not wish to encourage the Corporation in an appeal.

### WEST HARTLEPOOL.

AIR RAID PRECAUTIONS.

The Tramways Committee have decided, owing to mechanical reasons, that when the first air raid warning is given the cars shall be ordered back to the depots.

### WALTHAMSTOW.

PRAISE FOR WOMEN TRAMWAY EMPLOYEES.

Mr. W. Murray, manager of Walthamstow Council tramways, at a meeting in aid of the Prisoners of War Fund, said that if they wanted a thing well done, they should set women to do it. After three years' experience, if had been proved that after a little training some women could be found who could do almost any work on the tramcars that men had formerly done.

### YARMOUTH.

REJECTION OF A PROPOSAL TO ABANDON TRAMWAY SERVICE.

Owing to the necessity of repairing the tramways between the Hall Plain and the fishing village of Caistor, Yarmouth Corporation have discussed the question of closing down the whole undertaking until after the war. The General Purposes Committee reported against the suggestion by eleven votes to three, and recommended the repair of the Caistor section. The surveyor stated that the rails had ten years further life, the foundation being in perfect condition; but the rails needed repacking, three turnouts required to be removed and a number of joints welded. Rails were in stock to make good any found broken. To carry out the work with the present poor labour supply it would be necessary to close the line for three months. The Ministry of Munitions would not permit more than £500 to be spent, but the surveyor believed that the work could be done practically for that amount. During the discussion Councillor Middleton remarked that the surveyor's estimate was £1,200. The general manager reported that on the Caistor section the cars had rolled and oscillated since 1913, which was due to the rails being out of line at various places. The roll and oscillation could be minimised by reducing speed, which had been ordered. For the whole of the undertaking there were 18 cars in running order and 17 were waiting for spare parts, which he hoped would be obtained soon. He had been using parts from the laid-up cars to keep the others running. On the question of closing the whole undertaking, Councillor Knights asked how the electricity works would maintain their position without the £3,000 a year received from the tramways? As to the tramway deficit during the war, the borough accountant informed the Council that it was met by the town's share of the Government grant to the East Coast. The surveyor's report was adopted, and it was stated that that official hoped to execute the work without closing the line.

## CONTRACTS AND ORDERS.

**The Dewhurst Engineering Company** have received an order from Sunderland Corporation for steel tubes for the electricity department.

**Sydney Municipal Council** have accepted the tender of Messrs. W. Adams and Company at £6,182 for the supply of boosting plant for Castlereagh Street sub-station.

**Crompton and Company, Limited,** have received an order from Grimsby Corporation for a motor generator and switchgear for charging accumulators on electric vehicles.

**Electric Vehicles for Hampstead.**—Hampstead Borough Council have purchased two electric motor vehicles fitted with Edison batteries for the use of the medical officer of health's department. The chassis have special van bodies.

**Sheffield Corporation** have accepted the following tenders in connection with the emergency power-house at Blackburn Meadows:—Buildings, John Greenwood; structural steelwork, Gilbert Heathcote and Company; electric capstans, Clarke, Chapman and Company, Limited; boosting sets, Crompton and Company, Limited.

**Huddersfield Town Council** have contracted with the Woods-Gilbert (British) Rail Grinding and Milling Company, Limited, Strand, London, W.C., for the grinding and milling of some sections of the track which are badly in need of repair. It is anticipated that the use of the Woods-Gilbert system will prolong the life of the rails from five to seven years.

**L.C.C. Stores and Contracts.**—The current contracts for the supply of general stores, with a few exceptions, will expire on December 31, 1917, and the Stores and Contracts Committee recently reported that they were taking steps to obtain supplies during 1918. This group of contracts, which ordinarily comprises 45 schedules, is the largest of the several groups dealt with each year, and includes such goods as metals, electric cables, lamps, fittings and materials, chemical and scientific goods, rubber and asbestos goods, leather, oilman's sundries, petrol, etc. It is proposed to continue the practice of buying certain classes of goods at current market prices or until special quotations under trade conditions again become normal, or the time is more favourable for new contracts to be entered into. In other cases new forms of tender and schedules are being prepared. As the number of tenders would probably be comparatively large, the committee thought it desirable, as in previous years, for the tenders to be opened by them instead of in the Council, and this was agreed to.

## PATENT LIST.

### Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS FOR LETTERS PATENT.

Gas containers for motor vehicles (16,242)—R. Ames and W. F. Brown.

Air-brake apparatus (16,215 and 16,216)—Automatic Straight Air-Brake Company and W. Cross.

Apparatus for storing gas for use as fuel on motor vehicles (16,415)—J. F. Boyer, B. W. Hollis, and P. G. G. Moon.

Means for ventilating railway carriages and tramcars (16,226)—E. Dann and G. Farrow.

Motor cars driven by gas (16,541)—H. H. Gregory.

Railway switches (16,180)—P. Hansen and A. J. Joest.

Means for automatically regulating supply of gas to motor vehicle engines (16,306)—F. W. Hudlass.

Petrol or gas-driven vehicles (16,345)—E. F. Johnson.

Clutch and change-gear mechanism for motor vehicles (16,527)—F. W. Lanchester.

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*The Daily Telegraph.*

DEPRECIATION & WASTING ASSETS
AND THEIR TREATMENT IN COMPUTING ANNUAL PROFIT AND LOSS

*By P. D. LEAKE*

*Member of the Institute of Chartered Accountants in England and Wales, Fellow of the Institute of Directors, Fellow of the Royal Statistical Society.*

Particular attention is directed to a chapter on Depreciation and Controlled Establishments under the Munitions of War Act, 1915; and it may be added that the views of the Ministry of Munitions as to the proper treatment of Depreciation of Plant coincide with the views advocated in this work.

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Railway signalling systems (16,263, 16,264, 16,426)—McKenzie, Holland and Westinghouse Power Signal Company (*Union Switch and Signal Company*).
Fish-plates for switch tongues on railways (16,308)—A. V. Naylor.
Motor vehicles (16,356)—H. Newton.
Self-propelled vehicles (16,118)—W. Osborne & Co.
Petrol motors (16,291)—W. G. Ritchie.
High-pressure gas systems for motor vehicles (16,401)—G. H. Robinson.
Universal drive for motor vehicle wheels (16,430)—O. H. Rogers.
Flexible coal-gas containers for motor vehicles (16,227)—G. Spencer.
Rails for trams, trains, etc. (16,783)—T. J. R. Clarkson.
Life-saving device for road vehicles (16,577)—A. F. Fretwell.
Coupler for connecting trailers carrying gas-bags to motor vehicles (16,574)—H. H. Gregory.
Metal sleepers for rails (16,813)—J. T. John.
Rail fastening device (17,148)—J. P. Bergeron.
Long-arm for overhead system of electric tramcars (17,374)—M. Crumack and A. Senior.
Springing of road or rail vehicles (17,027)—F. W. Lanchester.
Construction and equipment of tramcars (17,257)—W. S. Laurie.
Appliance for use on tramcars for checking delivery of tickets (17,269)—F. L. MacLaren.
Railways (17,106)—H. O. Short.
Spring coupling device for motor traction (17,308)—G. W. Watson.
Train signalling and control systems (17,344)—C. H. Woodward.
System of lubrication for motor vehicle road springs (17,337)—F. Wright and J. Wright.

### Specifications Published.

1916.

Motor road vehicles (14,502—*110,190*)—O. Tilley and B. L. Wilson.
Brakes on electric tramcars (16,749—*110,231*)—R. H. Wilkinson and W. H. Turner.
Points and switches (15,690—*110,420*)—A. Morgan.
Motor road vehicles (18,382—*110,451*)—E. Dobson.
Trolley heads for electric tramcars (15,365—*110,612*)—C. Svombo.

1917.

Apparatus for the heat treatment of railway and tramway rails *in situ* (145—*110,253*)—C. P. Sandberg.
Non-skid devices for motor vehicles (1,173—*110,261*)—G. Gunther and W. P. Miller.
Lifting jacks for motor road vehicles (7,849—*110,517*)—F. L. Rapson.
Vehicles for street railways (10,640—*110,529*)—A. A. Kinney.
Car truck (1,750—*110,681*)—G. K. Thompson.

### MEN WANTED BY COLCHESTER TRAMWAYS.

The Colchester Corporation Tramways are in want of the undermentioned men, who must be either medically unfit for army service or over age. Application must be made by letter in the first instance. State experience and wages required. Any engagement will be for the duration of the war.

One shed foreman; one inspector; one general car fitter; one overhead linesman. R. C. Bullough, Manager.

## Colonial and Foreign Tramways Traffic Returns.

| NAME OF COMPANY. | 1916. WEEKS ENDED. Nov. 4. | Nov. 11. | Nov. 18. | Nov. 25. | 1917. WEEKS ENDED. Nov. 3. | Nov. 10. | Nov. 17. | Nov. 24. | | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Anglo-Argentine ... ... ... | 53.120 | 52.460 | 53.617 | 52.241 | 56.328 | 55,395 | 54,485 | 54,384 | ... | 47 | 2,438,833 | + 36,852 |
| Calcutta ... ... ... ... Rs. | 68.695 | 67.534 | 73.680 | 73.379 | 57.465 | 65,348 | 65.637 | 68.640 | ... | 47 | 3.195.377 | + 612 |
| Madras ... ... ... ... | (2 weeks) | 31.596 | (2 weeks) | 29,664 | (2 weeks) | 35.433 | (2 weeks) | 33,914 | ... | 47 | 765,562 | + 70,392 |
| Pernambuco ... ... ... .. | 3.453 | 3.504 | 3.555 | 3.400 | 4.313 | 4.333 | 4.279 | 4.333 | ... | 46 | 180.428 | + 35,981 |

## Companies Issuing Monthly Statements.

| | 1916. June. | July. | August. | Sept. | October. | Nov. | 1917. June. | July. | August. | Sept. | October. | Nov. | Wks. | AGGREGATE. 1917. | + or −. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Ballarat & Bendigo .. | 2.794 | 2.704 | 2.791 | 2.850 | 3.390 | ... | 2.849 | 2.593 | 2.693 | 2,816 | 3.560 | ... | 28 | 22.113 | + 3 |
| Brazilian Traction Mlrs | 7178000 | 7429000 | 7405000 | 7138000 | ... | ... | 7642000 | 7795000 | 8064000 | 7925000 | ... | ... | 39 | 68.430.000 | + 5,279,000 |
| Brisbane ... ... ... | 31.390 | 32.880 | 37.900 | 32.530 | ... | ... | 32,475 | 32.720 | 36.925 | 31,600 | ... | ... | 39 | 294,840 | - 2.820 |
| British Columbia $ | 400.814 | 411.847 | 423.738 | 414.811 | 445.263 | ... | 373.029 | 438.378 | 454.425 | 457.709 | 491,964 | ... | 17 | 1,842,476 | + 146,817 |
| Buenos Ayres Lacroze | 36.213 | 38.439 | 36.431 | 37.077 | 39.670 | 39.133 | 38.020 | 38.063 | 39,111 | 33,655 | 39,067 | 39,679 | 21 | 189.575 | − 1.214 |
| Burma ... ... ... | 24.027 | 26.340 | 24.413 | 23 749 | 29.768 | ... | 25.463 | 26.288 | 26.714 | 26.168 | 28.955 | ... | 13 | 81.837 | + 3,907 |
| Cape Town ... ... | ... | ... | 13.394 | ... | 14.238 | ... | ... | 16.067 | 15,480 | ... | 17,128 | ... | — | — | — |
| Carthagena & Herrerias | 3.512 | 2,371 | 2.081 | 1.779 | 2.539 | 2,252 | 5.325 | 5.763 | 4.164 | 4.306 | 2.805 | 3,932 | 47 | 45,142 | + 17,751 |
| Cordoba ... ... ... | 14.120 | 14.258 | 13.851 | 13.313 | ... | ... | 14.416 | 14,343 | 14,278 | 12,463 | ... | ... | 26 | 82.895 | − 1.588 |
| East India ... ... | 2.283 | 2.220 | 2.522 | 2.523 | 2.080 | 1.942 | 1.186 | 1.183 | 1.562 | 1.512 | 1.229 | 871 | 17 | 5,174 | − 3,893 |
| Kalgoorlie ... ... | 2.500 | 2.521 | ... | ... | ... | ... | 2.648 | 2.713 | ... | ... | ... | ... | 30 | 18.154 | + 696 |
| La Plata ... ... ... | 3.735 | 3.910 | 3.793 | 3.993 | 4.434 | ... | 3.852 | 3.875 | 4.076 | 3,450 | 4,069 | ... | 43 | 40.615 | − 1,441 |
| Lima ... ... ... | ... | ... | ... | 33.340 | 33.303 | ... | ... | ... | ... | 35.621 | 37.537 | ... | 43 | 359.732 | + 22,341 |
| Manaos ... ... Rs. | 144.913 | 152.380 | 147.774 | 141.286 | ... | ... | 165,693 | 162.157 | 150.657 | 157.761 | ... | ... | — | — | — |
| Manila ... ... $ | 59.432 | ... | ... | ... | ... | ... | 73.900 | ... | ... | ... | ... | ... | — | — | — |
| Mexico ... ... $ | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Monte Video ... ... | 25.300 | 25.220 | 26.044 | 26.711 | 28.729 | ... | 27,458 | 28,597 | 28,860 | 29.426 | 30,153 | ... | 52 | 359.832 | + 12.060 |
| Peruvian ... ... $ | 929.500 | 835.430 | 895.900 | 911.910 | 945.590 | 925.820 | 965,420 | 975.000 | 979,430 | 950,740 | 1047220 | 1034790 | 21 | 4.987,180 | + 472,530 |
| Port Elizabeth ... | ... | 3.166 | 2.863 | ... | 3.131 | ... | ... | 3.544 | 3.360 | ... | 3.885 | ... | — | — | — |
| Rangoon ... ... | 4.205 | 4.357 | 4.253 | 4.137 | 5.043 | 5.033 | 4,383 | 4.783 | 4.788 | 5,163 | 5.667 | 5,358 | 47 | 55,379 | + 1,975 |
| Toronto ... ... $ | 884.491 | 867.789 | 889.241 | 913.535 | 907.460 | ... | 984,529 | 954,192 | 1039819 | 1023517 | 1043886 | ... | 43 | 9.934,998 | + 1,021,774 |
| Winnipeg ... $ | 254,686 | 242,688 | 249.795 | 267,497 | 278,817 | ... | 254,226 | 242,797 | 248.457 | 267,170 | 301,722 | ... | 43 | 2,733,516 | − 6.755 |

(*Continued on page 412*)



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# TRAFFIC RETURNS—*continued.*

## Tramways and Omnibus Undertakings in the United Kingdom.

| NAME OF COMPANY OR CORPORATION. | 1916. WEEKS ENDED. Nov. 4. | Nov. 11. | Nov. 18. | Nov. 25. | 1917. WEEKS ENDED. Nov. 3. | Nov. 10. | Nov. 17. | Nov. 24. | AGGREGATE. Wks. | 1917. | Increase or Decrease. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | | £ | £ |
| Aberdare U.D. Council | 403 | 426 | 449 | 363 | 423 | 453 | 480 | 443 | 33 | 14.764 | − 1.265 |
| Aberdeen Corporation | 1.841 | 1.958 | 1.817 | 1.770 | 1.999 | 2.205 | 2.011 | 2.021 | 25 | 54.526 | − 6.051 |
| Accrington Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ayr Corporation | 272 | 271 | 265 | 262 | 323 | 341 | 328 | 335 | 128 | 14.467 | + 1.491 |
| Bath Electric | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Belfast City | 5.777 | 5.679 | 5.777 | 5.565 | 6.777 | 7.089 | 6.825 | 6.985 | 34 | 218.645 | − 24.664 |
| Birkenhead Corporation | 1.594 | 1.546 | 1.444 | 1.514 | 1.818 | 1.845 | 1.861 | 1.832 | 34½ | 62.932 | + 9.527 |
| Birmingham Corporation | 14.375 | 14.461 | 13.046 | 12.618 | 19.424 | 19.344 | 19.366 | 19.550 | 34 | 624.841 | + 74.315 |
| Birmingham Corp. Motor Omnibuses | 1.014 | 1.044 | 1.108 | 1.069 | 1.197 | 1.184 | 1.195 | 1.215 | 34 | 35.724 | + 1.177 |
| Blackburn Corporation | 1.086 | 1.108 | 1.139 | 1.021 | 1.325 | 1.366 | 1.395 | 1 328 | 34¾ | 51.934 | − 7.986 |
| Blackpool and Fleetwood | ... | 345 | 297 | ... | ... | 424 | 379 | ... | 43 | 41.623 | + 497 |
| Blackpool Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bolton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bournemouth Corporation | 2.047 | 2.082 | 1.832 | 1.891 | 2.452 | 2.259 | 2.321 | 2.291 | 34½ | 90.724 | − 7.578 |
| Bradford Corporation | 6.392 | 6.223 | 6.263 | 5.990 | 7.095 | 8.097 | 7.478 | 7.513 | 34 | 264.258 | + 28.452 |
| Brighton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Bristol | 5.046 | 4.704 | 4.730 | 4.461 | 5.619 | 5.777 | 5.456 | 5.492 | 47 | 255.386 | − 24.339 |
| Burnley Corporation | 1.695 | 1.574 | 1.535 | 1.522 | 1.789 | 1.841 | 1.856 | 1.821 | — | — | — |
| Burton-on-Trent Corporation | 287 | 272 | 263 | 263 | 317 | 329 | 307 | 325 | 34 | 10.624 | + 1.034 |
| Bury Corporation | 1.343 | 1.313 | 1.220 | 1.223 | 1.540 | 1.549 | 1.560 | 1.508 | 34½ | 57.282 | + 7.170 |
| Cardiff Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Chatham and District | 1.234 | 1.179 | 1.191 | 1.049 | 1.115 | 1.184 | 1.147 | 1.260 | 47 | 60.125 | − 2.064 |
| Chesterfield Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Colne Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Cork Electric | 499 | 493 | 513 | 458 | 542 | 556 | 545 | 572 | 47 | 25.918 | + 1.826 |
| Croydon Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Derby Corporation | 1.160 | 1.134 | 1.010 | 1.008 | 1.207 | 1.235 | 1.258 | 1.258 | 34 | 41.593 | + 2.137 |
| Dover Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin and Lucan | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Dublin United | 6.251 | 6.040 | 6.172 | 5.830 | 6.889 | 6.802 | 6.630 | 6.865 | 47 | 315.935 | + 30.240 |
| Dundee City | 1.370 | 1.363 | 1.355 | 1.326 | 1.463 | 1.504 | 1.531 | 1.535 | 27¾ | 42.370 | + 3.958 |
| East Ham Corporation | 1.269 | 1.227 | 1.225 | 1.101 | 1.239 | 1.328 | 1.272 | 1.312 | 34 | 47.882 | + 2.899 |
| Exeter Corporation | 387 | 389 | 372 | 388 | 386 | 388 | 369 | 373 | 34 | 13.972 | − 87 |
| Gearless Motor 'Buses | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Glasgow Corporation | 23.786 | 23.694 | 23.463 | 23.246 | 26.459 | 26.916 | 26.898 | 26.788 | 25¾ | 671.984 | − 76.999 |
| Glossop (Urban Elec. Supply Co.) | 146 | 139 | 134 | 134 | 164 | 175 | 164 | 173 | 47 | 7.271 | + 727 |
| Halifax Corporation | 1.875 | 2.021 | 1.980 | 1.774 | 2.209 | 2.235 | 2.247 | 2.312 | 33¾ | 84.446 | − 7.391 |
| Halifax Corp. Motor Omnibuses | 48 | 49 | 47 | 44 | 50 | 49 | 51 | 50 | 33¾ | 1.646 | − 49 |
| Hastings and District | 808 | 829 | 771 | 728 | 1.108 | 1.092 | 1.060 | 1.012 | 47 | 58.757 | + 9.499 |
| Huddersfield Corporation | 2.723 | 2.668 | 2.575 | 2.512 | 3.033 | 3.143 | 3.200 | 3.215 | 34 | 109.904 | + 11.499 |
| Hull Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ilford U.D. Council | 651 | 640 | 587 | 599 | 690 | 726 | 708 | 742 | 34 | 26.258 | + 2.748 |
| Ilkeston Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Ipswich Corporation | 440 | 421 | 418 | 396 | 613 | 569 | 562 | 574 | 34 | 23.718 | + 5 508 |
| Isle of Thanet | 286 | 279 | 244 | 235 | 151 | 160 | 147 | 150 | 8 | 1.323 | − 946 |
| Kilmarnock Corporation | 169 | 172 | 169 | 171 | 199 | 213 | 203 | 205 | 27½ | 5.501 | + 567 |
| Lanarkshire | 2.312 | 2.267 | 2.340 | 2.166 | 2.774 | 2.848 | 2.878 | 2.896 | 47 | 130.309 | + 21.307 |
| Lancashire United | 1.796 | 1.821 | 1.830 | 1.674 | 2.341 | 2.466 | 2.407 | 2.483 | 47 | 110.560 | − 24.547 |
| Leeds City | 9.641 | 9.417 | 9.418 | 9.146 | 10.739 | 10.922 | 11.032 | 11.006 | 34 | 377.552 | + 39.893 |
| Leicester Corporation | 3.435 | 3.353 | 3.336 | 3.307 | 3.864 | 3.960 | 3.940 | 4.064 | — | — | — |
| Leith Corporation | 864 | 846 | 834 | 811 | 1.025 | 1.052 | 1.055 | 1.047 | 27¾ | 29.965 | − 5.372 |
| Leyton U.D. Council | 1.520 | 1.503 | 1.513 | 1.351 | 1.701 | 1.772 | 1.838 | 1.817 | 34 | 64.508 | − 7.205 |
| Liverpool Corporation | 14.321 | 14.230 | 13.983 | 13.676 | 15.964 | 16.384 | 16.189 | 16.498 | 46¾ | 731.471 | − 68.572 |
| Llandudno and Colwyn Bay | 221 | 222 | 213 | 199 | 253 | 237 | 253 | 235 | 51½ | 17.833 | − 778 |
| London County Council | 47.482 | 45.549 | 47.356 | 43.319 | 52.306 | 54.084 | 55.476 | 55.271 | 33½ | 1.869.174 | + 237.089 |
| London General Omnibus | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| London United | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Lowestoft Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Maidstone Corporation | 196 | 197 | 199 | 176 | 217 | 221 | 221 | 219 | 34 | 8.410 | − 800 |
| Manchester Corporation | 18.641 | 18.514 | 18.108 | 17.928 | 20.762 | 21.096 | 21.009 | 21.493 | 34 | 705.840 | + 59,206 |
| Metropolitan Electric Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| National Steam Car | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Nelson Corporation | 198 | 185 | 185 | 194 | 242 | 223 | 224 | 215 | 34 | 8.051 | − 680 |
| Newcastle-on-Tyne Corporation | 6.998 | 6.918 | 6.772 | 6.572 | 7.944 | 8.022 | 8.064 | 8.000 | 34 | 268.042 | − 38.674 |
| Newport (Mon.) Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| New St. Helens and District | 1.056 | 1.049 | 1.039 | 922 | 1.188 | 1.233 | 1.223 | 1.254 | 21 | 31.144 | + 7.534 |
| Northampton Corporation | 735 | 739 | 724 | 720 | 851 | 844 | 836 | 865 | 33 | 28.636 | − 4.040 |
| Nottingham Corporation | 3.859 | 3.904 | 3.923 | 3.608 | 4.544 | 4.599 | 4.481 | 4.625 | 34 | 150.533 | + 15.729 |
| Oldham Corporation | 2.347 | 2.294 | 2.108 | 2.227 | 2.751 | 2.740 | 2.676 | 2.733 | 35 | 99.754 | + 12,071 |
| Portsmouth Corporation | 2.404 | 2.335 | 2,144 | 2.163 | 2.676 | 2.540 | 2.641 | 2.550 | — | — | — |
| Preston Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Provincial | 2.046 | 1.986 | 1.927 | 1.866 | 2.314 | 2.326 | 2.279 | 2.291 | 7¾ | 18.347 | + 1.959 |
| Reading Corporation | 904 | 850 | 838 | 802 | 1.120 | 1.097 | 1.051 | 1.044 | 34¾ | 36.030 | + 6.589 |
| Rhondda Tramways | 1.337 | 1.287 | 1.297 | 1.194 | 1.610 | 1.551 | 1.569 | 1.576 | 47 | 70.698 | + 10.216 |
| Rochdale Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Rotherham Corporation | 1.629 | 1.654 | 1.546 | 1.600 | 1.930 | 1.855 | 1.899 | 1,896 | 34½ | 62.701 | + 8.423 |
| Salford Corporation | 5.401 | 5.370 | 5.055 | 5.164 | 6.622 | 6.458 | 7.344 | 6.541 | 34¾ | 228.386 | − 38.062 |
| Sheffield Corporation | 10.588 | 10.849 | 10.353 | 10.585 | 12.352 | 12.320 | 12.511 | 12.484 | 35 | 421.229 | − 50.318 |
| Southampton Corporation | 1.771 | 1.676 | 1.666 | 1.512 | 2.151 | 2.133 | 2.082 | 2.011 | 33¾ | 69.477 | + 11 923 |
| Southend-on-Sea Corporation | 699 | 691 | 693 | 602 | 583 | 617 | 636 | 628 | 34 | 32.579 | + 1.023 |
| South Metropolitan Tramways | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| South Shields Corporation | 821 | 790 | 828 | 805 | 918 | 908 | 921 | 953 | 34 | 32.597 | + 3.672 |
| Sunderland Corporation | 1.631 | 1.631 | 1.555 | 1.627 | 1.837 | 1.807 | 1.836 | 1.838 | 34 | 62.411 | + 5.491 |
| Sunderland District | 647 | 647 | 644 | 646 | 812 | 793 | 756 | 801 | 4 | 2.351 | + 414 |
| Swindon Corporation | 201 | 196 | 207 | 192 | 254 | 257 | 261 | 258 | 33½ | 9.218 | + 2.209 |
| Torquay Tramways | 499 | 460 | 490 | 431 | 678 | 646 | 672 | 650 | 47 | 31.409 | + 3.264 |
| Tramways (M.E.T.) Omnibus Co. | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Tyneside Tramways and Tramroads | ... | 589 | 525 | ... | ... | 806 | 811 | ... | 21 | 18.921 | − 4.749 |
| Wallasey Corporation | 1.221 | 1.197 | 1.197 | 1.149 | 1.410 | 1.430 | 1.398 | 1.428 | 34½ | 54.952 | − 6.658 |
| Walsall Corporation | 814 | 808 | 807 | 747 | 1.010 | 1.020 | 1.022 | 1.037 | 34 | 33.537 | + 4.737 |
| Walthamstow U.D. Council | 1.002 | 955 | 938 | 915 | 1.089 | 1.136 | 1.136 | 1.152 | 34 | 42.654 | + 4.485 |
| Warrington Corporation | 524 | 521 | 513 | 491 | 579 | 671 | 672 | 674 | 34 | 18.806 | + 1.861 |
| West Ham Corporation | 3.160 | 3.027 | 2.997 | 2.781 | 3.353 | 3.542 | 3.613 | 3.659 | 33¾ | 124.515 | + 13.869 |
| Wigan Corporation | 1.697 | 1,729 | 1.705 | 1.646 | 2.087 | 2.133 | 2.123 | 2.153 | 34 | 7.904 | + 10.072 |
| Wolverhampton Corporation | * | ... | ... | ... | ... | ... | ... | ... | — | — | — |
| Yorkshire (West Riding) | 1.802 | 1.886 | 1.569 | 1.675 | 2.222 | 2.311 | 2.186 | 2.213 | 47 | 100.076 | + 17.361 |

### * TRAFFIC RETURNS SUSPENDED.

Owing to the European war, the Government have taken over the railways of Great Britain as from August 4, 1914, and the issue of traffic returns has been suspended. Consequently the traffic returns of the electric railways which usually appear on this page cannot be given.

The Publication of the Traffic Returns of the Tramways marked with an asterisk in the above table have also been suspended during the war.

### TRAMWAY DIRECTORIES.

A useful feature of this issue is the directory of electric railways and electric tramways which will be found among the advertising pages. This directory contains the names of the chief officials and the principal particulars relating to each undertaking.


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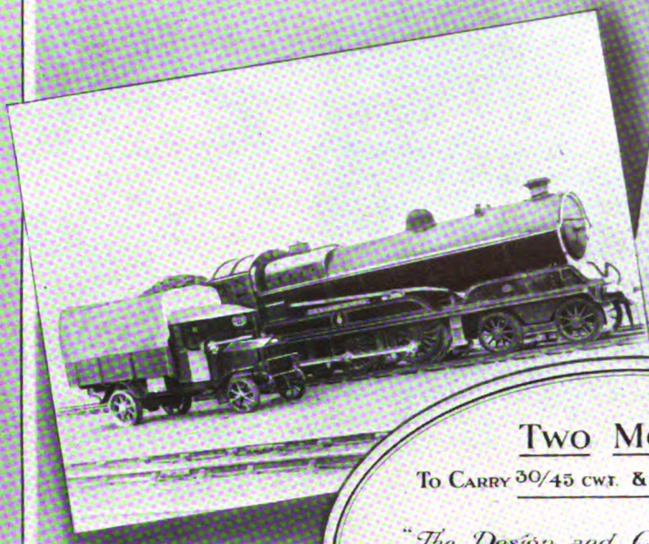
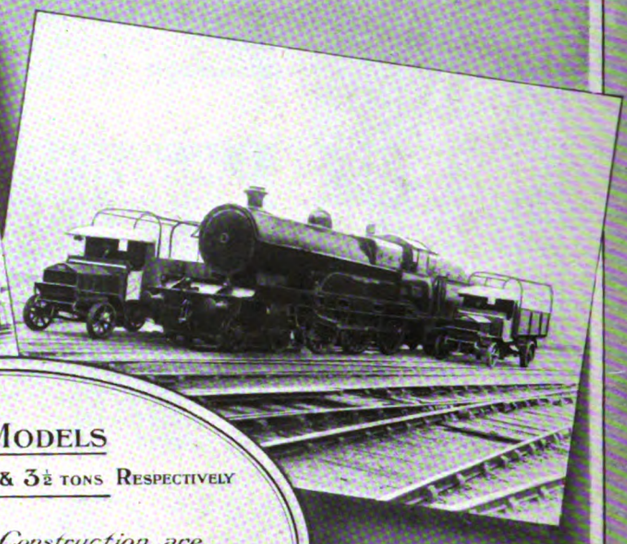
## MOTOR VEHICLES.





TWO MODELS

TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

*"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."*

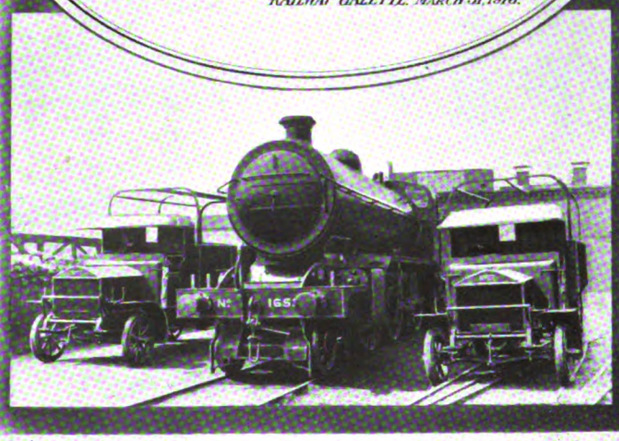
RAILWAY GAZETTE, MARCH 31, 1916.

IN PEACE

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.



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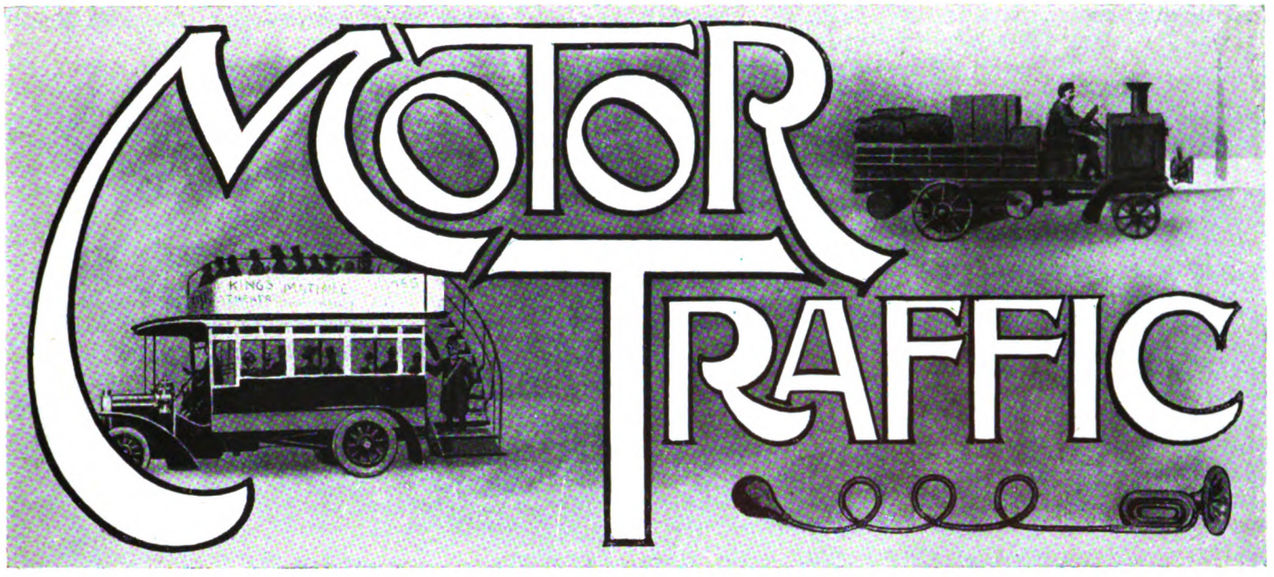


At the time of writing the latest news with regard to gas traction is the appointment by the Government of an Advisory Committee, whose names are given elsewhere in this issue, to investigate the subject, and to make representations as to what action should be taken to encourage and safeguard the use of gas for the purpose. A hint to the effect that motorists who are not qualified to obtain petrol may not be permitted to use coal gas had previously been given, but it is to be hoped that unless shortage of supplies makes action along these lines imperative it will not be taken. There are many purposes for which motor cars are usefully employed, but which are not regarded as sufficient qualifications in seeking permits for petrol supplies. Our public service facilities are already very much overtaxed, and it is not desirable, if it can be avoided, to congest them still further. The hint that coal gas may be reserved for what are regarded as essential purposes leads to the supposition that the next step may be a refusal to grant petrol to owners of commercial vehicles who cannot prove that the conditions of use of these vehicles are such as to preclude the possibility of employing coal gas as a fuel. The efforts that are being made to co-ordinate traffic facilities are all in the direction of limiting the radius over which industrial motors shall be used, and allocating long-distance haulage almost entirely to the railways. It is conceivable that we may finally reach a point at which petrol will only be granted to the Services, and for use to a limited extent on agricultural tractors employing paraffin as a main fuel.

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The work of traffic co-ordination appears to be proceeding simultaneously along three lines. One of these is the effort to co-ordinate rail and road transport, assigning to each the duties which it is qualified to perform most economically. In this attempt there must always be some exceptions to the general rule. In certain instances prompt delivery and the avoidance of handling *en route* are of more importance even than the saving of petrol or general economical considerations. This may well be the case with regard to the carriage of many classes of perishable foodstuffs, also of certain materials urgently required in connection with the manufacture of munitions of war. The second effort towards co-ordination lies along the line of endeavouring to obtain return loads for all vehicles. This is a policy the advantages of which we have pointed out on more occasions than one. To put it into effect, what is required is some central bureau that shall establish prompt communication between firms located in various centres. If a van is to run loaded from A to B, a trader must be found at B who wishes to have a load transported to A, or to some more or less intermediate point C, from which again another load can be taken to A. Thus the ton-mileage of the vehicle may be much increased without a corresponding increase in vehicle miles. Evidently some payment must be made to the owner of the vehicle by the other people who utilise it. It is considered wisest to base this payment on the capacity of the vehicle and the number of hours during which it is engaged. This is better than a payment based on mileage, because it discourages delays in loading and unloading, and this saving of time in turn tends to increase the mileage covered.

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A third method of co-ordinating traffic involves the fairly close co-operation of a number of trading concerns. Vans owned by individual traders often go out only partly loaded, and return nearly, if not quite, empty. If a number of traders can be made to pool their deliveries, fuller loads can be assured, and a smaller number of vehicles will serve the aggregate needs of the whole group. Thus a trader may at present operate half a dozen vans, not because he can fill them all, but because he has to serve half a dozen different districts. If he were to take part in a pooling scheme his vehicles might only serve the one or two districts where the bulk of his trade is done. For others he might be dependent on the services of vans owned by other traders in the group. This method of pooling will apparently be limited to a certain area of delivery from any particular centre, and each centre will have a specified area beyond which its traders may not deliver by road to their customers. The obvious objection to this proposition is that it interferes with normal trade competition, which might result in the public being exploited by local firms forming themselves into a ring to push up prices, and no longer restrained by fear of outside competition.

* * * * * *

It is a great pity that the whole question of the co-ordination of traffic and the elimination of unnecessary delays and expenses was not given proper consideration many years ago when congestion in London and other great cities had already become acute. We are reminded of our national negligence in this matter by the recent reception by the President of the Board of Trade of a deputation which asked for



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# MOTOR TRAFFIC.

a complete investigation into the principles and operation of Mr. Gattie's Central Clearing House scheme. The scheme has been before the public for a long time, but an inquiry into its possibility has been shirked by the Board of Trade, possibly from fear of antagonising great established interests, or as a result of the influence that these interests exert. The present position is that it is out of the question to attempt, as a war measure, to apply such a scheme on the scale which will be necessary to make it fully operative in London. Sir Albert Stanley gave its exponents a very friendly reception, and was undoubtedly right in limiting the encouragement offered to them at the moment to a clear indication that facilities would be freely granted to apply the scheme promptly on a moderately large scale at some point other than London where serious congestion and delays are common. We hope that the promoters will be contented with that suggestion, and will make haste to act upon it. If, as seems very probable, the scheme proves fully successful in practice, its effect upon our railway rates and the speed and transport of goods will in a few years be enormous. The experiment must first be tried on a reasonable scale, because, however small the risk of failure, no risk at all could be taken in the case of London, because the consequence of failure would be too appalling. Briefly, if the scheme pans out thoroughly well in practice, it will mean immense economies due to the scientific sorting of good and the elimination of terminal delays, and though primarily intended as a means of increasing efficiency of the railways, it must affect almost equally the future of road-borne traffic, eliminating the slow-moving vehicle from our streets and substituting a much smaller number of capacious but reasonably speedy motor lorries. The effect should then be a very fair solution of the great problem of removing traffic congestion.

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It is of interest to ascertain if any steps can be taken to ease the present burden on road users and the authorities responsible for upkeep. The matter was surely of sufficient importance to have been considered by the Reconstruction Committees appointed by the present Government and their predecessors. Failing that course it is worth while to examine the views expressed by road engineers at the annual conference of the Institution of Municipal and County Engineers. Their opinions came to light during the consideration of the question of "Extraordinary traffic and excessive weights on highways," introduced by Mr. Wakelam, county engineer of Middlesex. A great part of his paper had reference to omnibus traffic, beginning with the Abingdon Rural Council's action against the Oxford Tramways Company, in which damages working out at about 3½d. per car-mile were awarded, and upheld in the appeal court. The tenor of the debate was that litigation under this heading is a lottery. In our estimation it belongs to the dark age, when the vehicle was made to fit the road, as an article in our issue of August 9 described it. More satisfactory is Mr. Wakelam's support of the principle of the charge of ⅜d. per car-mile on omnibus traffic which was granted by Parliament to his Council in the Act for the construction of the Great West Road; that is a continuation of the policy adopted in regard to omnibuses and railless trolley cars run by municipal bodies outside their own boundaries.

There were only two passages in the address that may be classed as suggestions for relieving present difficulties. One was a plea for amended regulations as to speed; the other for a reduction in size and weight. The former is feasible as a condition of granting licences, as has been seen in Neath, where, according to the surveyor of that borough, very little damage has been done to the roads in the centre of the town, though it is greater on the outlying portions, where it is impossible to keep observations on the speed. Nor can this be remedied by fitting governors to the engines, as is the case with many commercial machines. Governors would be designed to limit the speed to the legal maximum of 12 miles, and although such a provision was insisted upon in the regulations issued by the Metropolitan police seven years ago it has never been enforced. Instead, in order to compel observance of the legal limit the police rely upon timing as in the case of motor cars. Doubtless Mr. Wakelam obtained the suggestion of introducing a smaller and lighter vehicle from the recent proposal of the Commissioner of Police, in connection with the new vehicles that will be required on the termination of the war. Sir E. Henry's project, however, is not viewed with approval by omnibus operators and builders, the retention of the present seating capacity being considered necessary for profitable working. In an amended list of suggestions published in this issue the Commissioner makes it clear that he has no intention of securing a reduction in seating capacity.

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Several other ideas advanced by Mr. Wakelam failed to secure support from surveyors whose roads carry heavy omnibus traffic, notably Birmingham and Sheffield, where the local authorities own the vehicles. Mr. Stilgoe, of the former city, declared that to-day it was impossible to regard motor vehicles as extraordinary traffic, and he insisted that the general increase of traffic must be met by better construction, for such traffic meant increased business and local profit. Mr. Hadfield rightly stated that large profits were not made outside of London; therefore it was useless to ask owners to make large contributions to the rates. In Sheffield, he remarked, there are water-bound and tar-bound roads over which omnibuses had run for four years without complaint. Mr. Silcock (Westminster) clinched the argument against a contribution by stating that provincial areas should not pay more than metropolitan (where nothing is paid), because the takings were less. On the general claim advanced by Mr. Wakelam for a contribution for extraordinary traffic, the speakers were mostly in favour of arranging settlements. If their arguments mean anything, it is that the Abingdon case implies a stretching of the law, which was intended to apply only to the haulage of materials.

## POST-WAR USE OF LORRIES.

In view of the injury that would be occasioned to the motor industry by the indiscriminate disposal of Government motor lorries after the war, the Society of Motor Manufacturers and Traders have made known their views on the question to the Ministry of Reconstruction. Dr. Addison, who is at the head of the Ministry, recently set up an Advisory Committee to consider the disposal of surplus Government property and stores after the war. The committee will hasten on the preparation of inventories by Government departments. In a statement issued on November 24, the Ministry invited suggestions from the public as to post-war use of Government stores.

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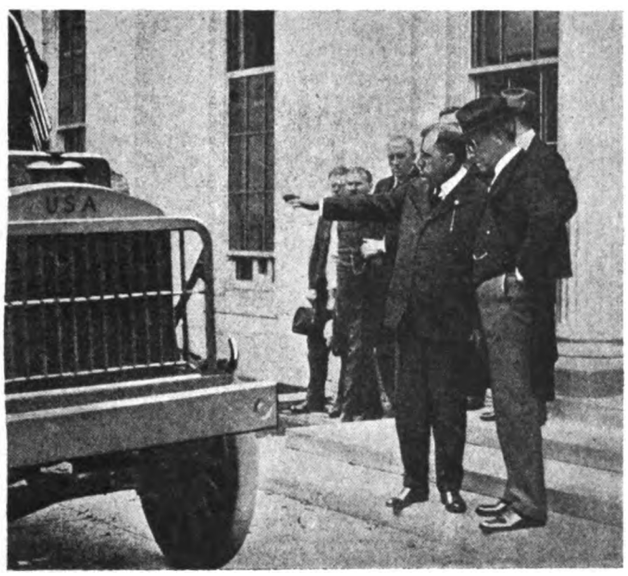
# MOTOR TRAFFIC.

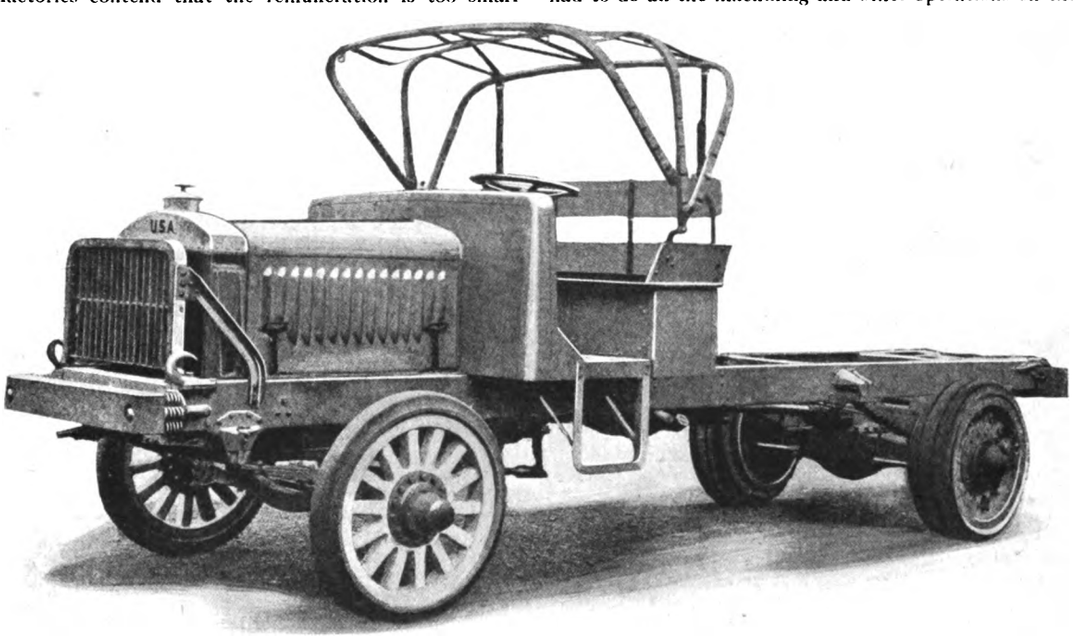
## UNITED STATES ARMY WAR SERVICE TRUCK.

On this page we reproduce photographs of the Class B motor truck designed at the instance of the United States Government for war service in Europe. Thirty-five thousand of these standardised vehicles are being made as a first instalment. The assembly was completed in three days and three nights, one being put together at Lima, Ohio, and one at Rochester, New York, and afterwards driven to Washington as a test before parts are put through in quantities.




**President Wilson Inspects the First Army Truck at the White House.**

The *Commercial Vehicle*, of New York, states that the pay to the assemblers is to be cost plus 15 per cent., and that some well-established factories contend that the remuneration is too small and will entail too great a sacrifice on their part. Our contemporary urges that as the Government are going to buy the parts they should eliminate difficulties with the assemblers by determining to build their own trucks.




**The United States Army War Service Truck.**

### Weights of Principal Units.

Class B truck is designed for a 3-ton load and a capacity for 5 tons. Criticisms as to the truck being too heavy for its carrying capacity have been largely dissipated by official weight figures. The weight of the chassis without body is 8,600 lb., which, with a 1,600-lb. body, will bring the total up to 10,000 lb. This is very little heavier than some of the best 5-ton trucks now on the market. There are several places where weight can be reduced with ease.

The motor weighs 1,012 lb., which is scarcely more than 100 lb. above the weight of engines for similar trucks now on the market. The rear axle weighs 1,592 lb., the front axle 352 lb., the gear box and gears 233 lb., the clutch and case 103 lb., the frame without castings 653 lb., the front springs 148 lb., the rear springs 544 lb., and the body 1,600 to 1,800 lb. With different makers these weights vary from 40 to 50 lb. in the cases of the motor, and there are smaller variations with other parts.

The assembling and the designing constitutes a new record, the first truck, according to schedule, having to be ready for the road October 10. It was ready two days ahead of schedule. The two trucks assembled as experimental ones have exceeded the expectations not only of General B. Baker, of the Quartermaster's Department, which has directed the work, but also the expectations of 40 engineers who worked on the designs in Washington. Early motor tests showed 58 H.P. at 1,350 revolutions per minute, and the engine torque curve has been better than anticipated. The first orders for 10,000 parts were widely placed over the industry, generally three or more different firms receiving orders for each of the different parts.

### Speedy Production.

There were four major divisions of the engineering work, (1) the engine, (2) the transmission, (3) the axles, and (4) the chassis parts. Each was executed by a corps of engineers. There were three, four, and in some cases five different companies represented in the work on one unit. The engineer best qualified for a certain task handled that in consultation with his fellow engineers.

It was unbelievable to many that the truck could be designed and produced in the stipulated time. The speed with which the different makers completed their respective tasks is shown (the *Commercial Vehicle* states) by the following:—

The Continental Company, which was one of the several engine firms to work on the engine, got blue prints on October 9 and the engine was running in 19 days and 18 hours.

Waukesha got the first engine running in 11 days 7½ hours from the time the blue prints reached them. The patterns for castings and dies for forgings had been previously made, but the companies had to do all the machining and other operations on the parts.

In developing the engines, four or five makers co-operated by dividing the different parts among them, one firm making several parts, not only for itself but for the other engine makers. Thus, Continental made the cylinders, gear case cover and many small parts

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# MOTOR TRAFFIC.

such as pumps, bushings, etc. Waukesha manufactured the cylinder heads, the crank case, intake and exhaust manifolds, roller push rods, etc. Wisconsin made the lower part of the crank case.

The engine is a composite design, involving a combination of the best engineering knowledge of the country. Thus in summarising the co-operating talent embodied in it, it might be said that the crank case is Continental, the cylinders Waukesha, the oiling system Wisconsin, the pistons Hercules, and the timing gear system a combination of Buda, Wisconsin and Continental. The governor is a combination of Kelly-Springfield and Waukesha. The cam shaft is a composite design.

VIBRATIONLESS ENGINE.—MASSIVE RADIATOR GUARD.

The engine was built in the Continental plants but is the result of Continental, Waukesha, Buda, and Wisconsin engineering and manufacture. It is said to be vibrationless and has detachable heads with cylinders measuring $4\frac{3}{4} \times 6$. The crank case is aluminium.

The axles, both front and rear, embody both Timken and Sheldon design. The rear axle is a full-floating type. Wheels were to have been steel, but could not be obtained, so wood was used. The engine has been designed for the use of heavier fuels, including kerosene.

The petrol supply is carried in a tank under the seat and fed to a dash tank, whence it goes to the carburetter by gravity. On the main tank there is a large faucet, so that fuel can be drawn quickly and put in the dash tank in emergency. The clutch is a dry disc,

**United States Army Truck with Hood.**

and the 4-speed gear was built by the Warner Company and is the result of engineering design and construction of several companies. The universals are Spicers.

The radiator is an extremely thick one of the cast type, protected by a massive guard. There is a coil spring bumper both front and rear. Another feature is the use of hollow spring shackle casting in which oil can be carried and fed by wick to the spring shackles and bolts. The brake control brackets are lubricated in the same way. The photographs do not show the front fenders, which are very strong. They form a platform on which the mechanic can sit or stand when repairing the engine. The frame is very securely braced, especially at the rear, and provision is made for fitting a trailer hook.

INSPECTION BY PRESIDENT WILSON.

Upon the arrival of the trucks at Washington, whither they had journeyed under their own power over the mountains, President Wilson and his Cabinet viewed them in the White House Park. Mr. H. L. Horning, chairman of the Automotive Products Section of the War Industries Board, explained the features of the truck, and mentioned that it had been produced two days ahead of the schedule. The President was interested to learn that the truck can operate on inferior grades of fuel if the necessity arises.

Secretary of War Newton Baker said that he knew of no greater evidence of the enthusiasm of the people in co-operating in preparation for the war than the two mechanical triumphs that had been worked out in the production of the Liberty motor for the airplane service and the standardised truck for army transport.

Since the description of the truck was written there has been a change from demountable tires to the pressed-on type. The complete truck with body, top, and equipment weighs just over 10,000 lb. (5 tons), the chassis, with driver's seat and in running condition, scaling 8,600 lb.

## THE CONSTRUCTION OF MOTOR OMNIBUSES.

REVISED SUGGESTION BY THE METROPOLITAN POLICE.

Sir E. Henry, Commissioner of Metropolitan Police, has issued the following notice inviting the co-operation of manufacturers and designers of motor omnibuses :—

The Commissioner of Police of the Metropolis, as the authority for licensing public carriages, issued a notice dated April 3, 1917, with regard to the future construction of motor vehicles intended for licensing as motor omnibuses within the Metropolitan area. Since that date he has received several communications from those concerned with the manufacture and use of these vehicles. In 1909, acting upon expert advice and after a conference with manufacturers and users, the Commissioner notified that no new vehicle would be licensed for public service which exceeded three and a half tons unladen weight, or, alternatively, which exceeded a gross weight fully laden of six tons.

Even with those limitations of weight, representations are still being received from residents along omnibus routes, who complain of the excessive vibration caused by these vehicles, and of the damage done to their houses. As stated in the notice of April, 1917, the present time appears opportune for reviewing licensing requirements, and summarising those deemed of cardinal importance.

It is not proposed to insist upon vehicles of smaller dimensions or with less seating capacity than the existing type. On the other hand, it is not contemplated to agree to any increase in size or in seating capacity, as the existing scale of a maximum of 34 seats best meets London traffic requirements.

It is realised, in respect of the weight of the vehicle and weight effect on roads, that improvements may be secured by careful reconsideration of all the details of construction of the chassis, road wheels, power and transmission mechanism, including the use of modern materials of high mechanical properties, and that the reduction thereby effected will compensate for any slight additions of weight needed for the improvement of springs, wheels, etc.

In the Commissioner's opinion, he would be justified in agreeing to some increase of weight in component parts needed to secure improvement in springing and in the wheels, the object aimed at being reduction of impact shock, more especially on damaged road surfaces, but for this increase of weight in certain parts there should be a reduction elsewhere.

In summarising the points of cardinal importance, attention is called to the following :—

1. The seating capacity of the motor omnibus shall be for not more than 34 passengers.
2. The weight shall not be more than three and a half tons unladen or six tons fully laden.
3. The weight must be so distributed that the front wheels are not unduly loaded.
4. The length of the vehicle must not exceed 23 feet.
5. The breadth overall must not exceed 7 ft. 2 in. at any part.
6. Each vehicle must be provided with two effective and independent and independently operative brakes acting on the back wheels.
7. The wheel track should not be less than 5 ft. 6 in. centre to centre of tires for both front and back wheels.
8. The distance between the outsides of the back springs shall not be less than 45 in., and of the front springs not less than 38 in.
9. The requirements as laid down in the Notice to Proprietors of August, 1909, may be referred to, but the Commissioner does not think it advisable to enter into greater detail lest he should thereby appear to be hampering designers.

The Commissioner invites the co-operation of manufacturers in designing and constructing vehicles which can operate in the streets without affording ground for complaints. Any representations that may be put forward will, of course, receive the most careful attention.

REGISTERED TRUCKS IN THE U.S.A.—The number of registered trucks in the United States at the end of the first six months of 1917 was 135,603. This does not represent the total number of trucks in use, which was probably near the 500,000 mark, but simply includes those where the State authorities register a commercial vehicle as such, rather than classing it in with the passenger cars under the head of motor vehicles. In the States which register trucks, New York is the leader with 54,856, Massachusetts next with 21,974, Pennsylvania next with 14,785, and Connecticut next with 9,957. These figures have since been largely increased owing to purchases of motor vehicles in order to relieve railway congestion created by the entry of the U.S.A. into the war.

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# MOTOR TRAFFIC.

## GAS TRACTION COMMITTEE.

It was officially announced on December 1 that Mr. Walter Long had made the following appointments to the Gas Traction Committee which the Government recently decided to establish :—

Sir Boverton Redwood, director of Technical Investigations, H.M. Petroleum Executive (chairman).
Major Aston McNeill Cooper-Key, C.B., H.M. Chief Inspector of Explosives, Home Office.
Sir Evan D. Jones, Petrol Controller, Board of Trade.
Mr. H. H. Law, C.B., Chief Engineering Inspector, Local Government Board.
Sir Arthur Churchman, Controller of Mineral Oil Production, Ministry of Munitions.
Mr. W. Doig Gibb, Technical Adviser on Gas-Works Products, Ministry of Munitions of War.
Dr. Charles C. Carpenter, Ministry of Reconstruction.
Mr. Edward S. Shrapnell-Smith, chairman of Joint Committee of Mechanical Road Transport Associations, Economy Officer H.M. Petroleum Executive.
Mr. James Ollis, Chief Officer, London County Council Public Control Department.
Lieutenant-Colonel R. K. Bagnall-Wild, R.E., member of Technical Committee of the Motor Industries, President of the Institution of Automobile Engineers.
Mr. F. W. Goodenough, chairman of Executive Committee of British Commercial Gas Association, member of National Gas Council.
Alderman William Kay, chairman of Manchester Corporation Gas Committee, member of National Gas Council.
Mr. George W. Watson, Inspecting Engineer to the Commercial Motor Users' Association (Incorporated).
Mr. W. Worby Beaumont, Technical Adviser to the Commissioner of Police of the Metropolis.

The terms of reference are—To consider and report upon :—

1. The employment of gas in substitution for petrol and petroleum products as a source of power, especially in motor vehicles, and the manner in which such gas may be supplied, stored, carried, and used, with due regard to the safety of the public.

2. The action, if any, which should be taken by His Majesty's Government to encourage and safeguard the use of gas for this purpose.

Mr. Shrapnell-Smith will act as secretary for the time being, and communications should be addressed to him at 8, Northumberland Avenue, W.C.2.

## GAS IN USE ON G.W.R. ROAD VEHICLES.

The *Great Western Railway Magazine* states that the company are making a start with gas as fuel for some of their large fleet of passenger and cartage road motors, the Lyon-Spencer container being used. In an article describing the conversion to gas traction the feeding of gas to the engine is described as being "easily effected, the simplest method being to tap a jet (about ⅜ in. for 3-ton vehicles) into the induction pipe and to interconnect a gas throttle with the one already located between the carburetter and induction pipe. Other variations of method can be made, more complicated than this, but producing a more complete admixture of the gas and air. One of the great advantages of gas is the negligible additions which have to be made to the engines, it being suitable without preparation for any engine designed to run on petrol, benzol, or hydrocarbon spirit.

"In the case where road vehicles (such as railway passenger or parcel cars) are timed to fixed schedules, what may be termed 'composite' running can be made a basis of operation ; i.e., where the necessary time between the trips is sufficient to allow for recharging the gas container (about 15 minutes), gas can be used as fuel ; whereas, where the time is shorter, the petrol cock can be opened, and that trip carried on on the latter fuel.

"Gas companies mostly charge for gas for motor traction by the fixed capacity of the container at so much a recharge ; so that it is sometimes advisable to have a container of such a size as will ensure its being quite empty when taken to recharge, running the last quarter-mile on petrol.

### The Compressed Gas Problem.

"It seems obvious that the flexible container cannot be the last word, and many inventive minds are busy on the problem of carrying compressed gas in cylinders. At the present time compressing plants and metal for suitable cylinders are almost impossible to get, and the flexible container will probably remain with us as a war-time emergency.

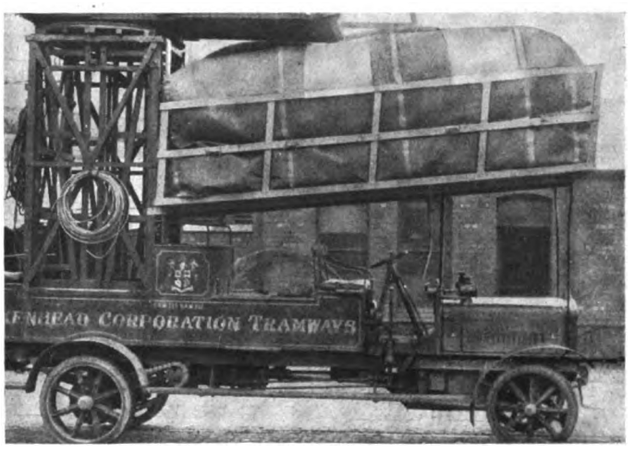
"About 250 cubic feet of coal gas give equivalent *power* to one gallon of petrol ; and a single cylinder compressor of 4-in. by 5-in. stroke, running at about 400 revolutions per minute, would fill a cylinder with 250 cubic feet of gas at a pressure of 20 atmospheres in about 15 minutes. It is not hard, therefore, to work out the requirements for any road motor vehicle in the direction of compressed gas.

"The limitations are (1) *weight*, which points either to composite thin cylinders having strengthening rings shrunk on at intervals and longitudinal tie rods, or to some alloy metal lighter than steel, being employed ; (2) *upkeep*, having in mind the stresses involved ; and (3) *life of material*, being highly stressed metal subjected to continuous shocks from the vehicle's motion. Also with compressed gas a governor is involved, whereas the flexible low pressure container acts as its own governor, the engine just sucking from it what it requires and no more.

"An attractive proposition is the possibility of vehicles which have short runs and sufficient time between trips, carrying their own gas compressors operated by the main engine whilst the car is standing."

## TOWER WAGON WORKED BY GAS.

We are indebted to Mr. C. Clarke, manager of Birkenhead Corporation Tramways, for the accompanying photograph of a tower wagon fitted with a gas container. The wagon is a 35-H.P. Halley




chassis, and the gas container measures 12 ft. by 6 ft. by 5 ft., and has a capacity of 360 cubic ft. This charge is sufficient to run the wagon from seven to eight miles. It has been working quite satisfactorily for several weeks.

## WAYSIDE SUPPLIES FOR MOTORS.

At a meeting of the Institution of Municipal and County Engineers, held on November 30 at the Geological Society's Rooms, Piccadilly, there was a discussion upon the questions raised by the circular letter sent to local authorities by the Commissioner of Police for the Metropolis relative to the installation on the highways of supplies of power or fuel for motor vehicles. The matter was discussed under the following headings :—

As to charging places in public highways for motor vehicles.

As to providing places and positions for taking in gas, electricity, petrol, coal, water, etc., for motor vehicles.

As to the powers of gas companies, electricity undertakings, etc., and of users of highways for such purposes.

Any other matter bearing upon or incidental to the above subjects.

The openers of the discussion were Mr. J. A. Brodie (Liverpool), Mr. A. E. Collins (Norwich), and Mr. H. E. Stilgoe (Birmingham).

Reporting on the subject to the Lambeth Council, the borough surveyor states that in the past few years the Council have found it necessary to remove most of the water standposts used for the filling of water-cars from the main roads to side streets. Moreover, the pavements of main roads already accommodate lamp-posts, tramway stopping signs, pillar-boxes, electric feeder pillars, sand-bins, etc., and any further encroachments would be undesirable. In certain side roads, where vehicular and pedestrian traffic is of a light nature, there would seem to be no great objection to the installation of plugs, stand-pipes, etc., for supplying motor vehicles, but such positions would need careful selection. In the case of water supply required for the use of steam wagons, for which there seems to be an urgent demand, it is suggested that standposts should be provided by the Metropolitan Water Board at various cab ranks, from which supply could be taken, and controlled either by some form of automatic prepayment meter or a man in attendance.

Use of Lorries to Relieve U.S.A. Railways.—An appeal has been made to traders in the United States to use motor vehicles for distances up to 40 miles, in order to relieve the pressure on the railways entailed by military traffic.



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# MOTOR TRAFFIC.

## LONDON "SAFETY FIRST" COUNCIL.

USEFUL AND EFFECTIVE PROPAGANDA.

A meeting of the London "Safety First" Council was held on Wednesday, November 21, in the Council Chamber of the Guildhall, Westminster. Mr. W. Joynson-Hicks, M.P., presided. It was reported that the Beckenham Urban District Council had joined the Council. Messrs. W. J. Pincombe, secretary of the London Teachers' Association, and C. W. Crook, B.A., B.Sc., ex-president of the National Union of Teachers, were co-opted as members of the Council.

The Drivers' Educational Committee reported that it had under consideration particulars, which had been submitted to it for criticism, of a "Safety" cradle for horseless vehicles; also, that it had given directions for the issue of a new poster. "Don'ts for Cyclists," and that later on the "Hints to Drivers" should be issued in the form of an illustrated poster. The Publicity Committee announced that, to meet the demand for the "Safety" poster for pedestrians, an additional 5,000 copies had been authorised.

The Publicity Committee reported that the promotion of the "Safety First" essay competition for children had been sanctioned by the London County Council and other education authorities in Greater London.

Upon the joint recommendation of the Street "Safety" and Publicity Committees, it was decided to ask certain local authorities again to consider the question in view of the consensus of opinion in favour of the "Keep to the Left of the Footpath" movement.

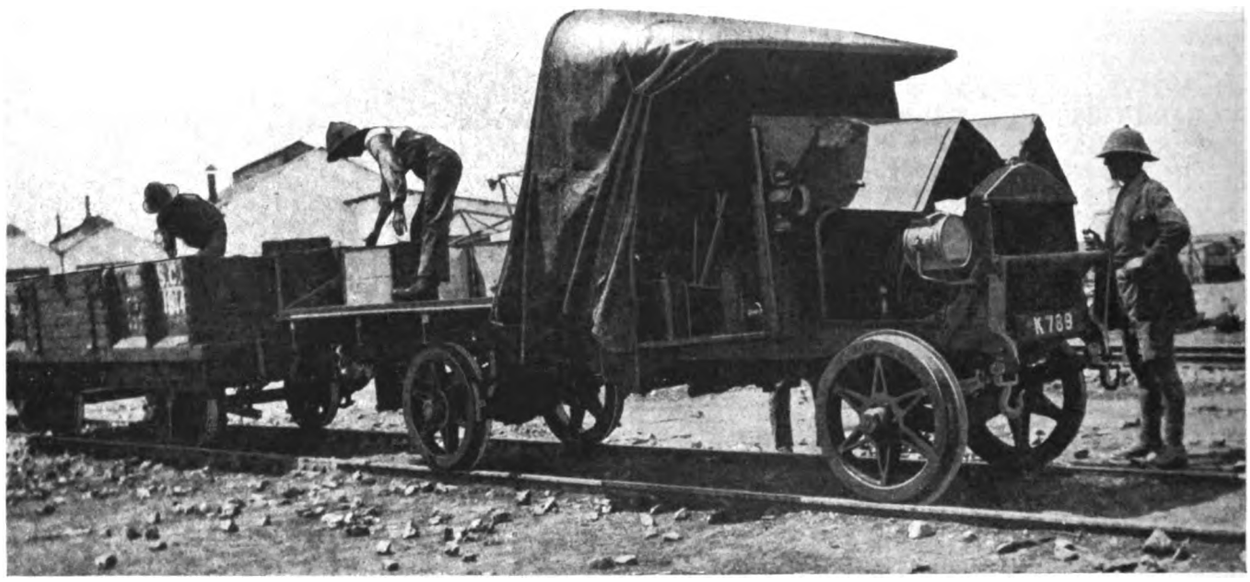
The Railway "Safety" Committee reported that, to meet the demand therefor, arrangements had been made for the supply of 10,000 copies each of two posters entitled "Safety: Advice for Railway Employees," and "Safety: Advice for Railway Travellers," and, in addition, a number of cards containing suggestions for the prevention of accidents in railway workshops.

## RESTRICTION OF OMNIBUS TRAFFIC.

Cumberland County Council have received an application from the Gretna Motor Company for sanction to use main roads for a motor omnibus service between Carlisle and Annan. After considering a report from the surveyor, the Highways Committee resolved that the consent be granted, on condition that a contribution be paid at the rate of 1¾d. per omnibus mile; that such consent shall be liable to revision at such time as the committee may deem necessary, and that in no case shall the company run a more frequent service than that stated in the application without the further consent of the committee.

Application having been made to Ellesmere Urban Council for sanction to an omnibus service proposed to be instituted on the North Road, the Council have replied that they cannot entertain the application at the present time.

In a report presented to Northamptonshire County Council, the Highways Committee state that the motor omnibus traffic on the main roads is greater on Sundays than on any other day of the week, and that it consists largely of non-essential traffic. In view of the excessive damage caused to the roads, the reduced supply of road materials, and the shortage of petrol, the committee were of opinion that Sunday traffic should be reduced to a minimum during the period of the war, and they recommend the Council to request the Government to give effect to that view.




A Napier in Railway Service.

## PRICE OF MOTOR FUEL REDUCED.

Following upon the recent 2½d. per gallon reduction, the companies forming the Pool Board (Petroleum Supplies), owing to further reductions in the Government war risk insurance upon vessels, reduced the wholesale prices of war motor spirit on November 26.

The new wholesale prices effect a reduction of 2d. in retail prices to the public of war motor spirit, the current prices of which in England and Wales are now as follow:—No. 2 war motor spirit, 3s. 7d. per gallon; No. 3 war motor spirit, 3s. 6d. per gallon; Scotland and Ireland, 1d. additional.

A reduction of 1d. per gallon in the prices of petroleum oil has been made for the same reason.

## L.C.C. AND THE RISK OF LEAKAGES IN GARAGES.

The Public Control Committee of the London County Council on November 14 presented a report on gas-filling installations at garages. As the filling process may possibly occupy a considerable time, there is risk, the committee stated, of inattention on the part of the operator which may result in a serious leakage of gas. The committee have, therefore, considered what precautions should be taken to avoid risks from installations fitted up at premises licensed to store petroleum spirit. It does not seem necessary to take any action if the gas-filling point is in the open air and at a distance of not less than 20 ft. from the petroleum storage place or filling point, neither does it appear necessary to raise objection to cars fitted with gas containers being garaged with petrol-driven cars if the garage is artificially lighted by incandescent electric lamps and is well ventilated at the roof level. As it is possible that, in the near future, an increasing number of these gas installations may be provided, the committee are in communication with the owners of garage premises licensed by the Council under the Petroleum Acts with a view to efficient measures being taken to obviate any risk of accident occurring through the means adopted for filling the gas receptacles or for lighting the premises. The committee will report after experience has been gained as to the general conditions which the Council should impose.

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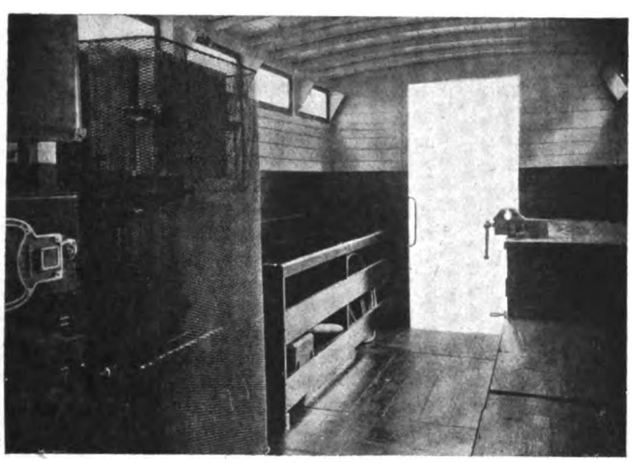
# MOTOR TRAFFIC.

## MOBILE ELECTRIC WELDING PLANT.

The accompanying views illustrate a mobile electric welding vehicle which Messrs. Tilling-Stevens, Limited, recently supplied

to Messrs. Fraser and Fraser, engineers and boilermakers, Bromley-by-Bow. This vehicle was supplied by permission of the Ministry of Munitions, and is completely equipped as an electric welder, with



the necessary control switchboard, relay switch, resistance cables, and electrodes, and the interior of the body is fitted as a workshop suitable for doing small repairs on the spot.

## WALSALL OMNIBUS DISPUTE.

As a final effort to obviate litigation, the secretary of the Birmingham and Midland Omnibus Company has appealed to Walsall Watch Committee to grant licences for their motor omnibuses, but the committee have replied that they are unable to depart from their refusal. It will be remembered that the refusal was based on the alleged duplication of public services on the Walsall portion of the route, and also on the need for national economy in the use of petrol. The company continued to run their vehicles in Walsall, taking up passengers on private property. Consequently proceedings were taken before the local magistrates, who decided against the company, but the chairman suggested that an arrangement should be arrived at. In his letter to the Watch Committee the secretary says: – "Instead of acceding to the suggestion of the justices, your Council insist on the discontinuance of the through service between Walsall and Birmingham. To this my directors cannot agree, and in the face of the refusal of your Corporation to grant licences they must adhere to the method they have adopted to meet the convenience of the public, which method, they maintain, is legal, and will be upheld by the Court of King's Bench. It is in the national interests at the present time that the railways should be relieved as much as possible, and public announcements to this effect have been made from time to time, while with regard to the use of petrol and to the reference made to the company's communications, I can say that every endeavour has and is being made to economise in this direction, and as an example I might quote the company's experiments in the use of coal gas as a fuel. My directors have had many examples of the public inconvenience created by a change of vehicles *en route*, and of the impossibility of thus properly catering for the large number of passengers who travel by road between Walsall and Birmingham. It is well known to your Council that the public have often to wait their turn at the Walsall terminus for a seat in an omnibus. My directors ignore the statement that the service is a pleasure service only, which is refuted by the large number of passengers using the vehicles in cold, wet weather."

## MOTOR VEHICLES FOR MUNICIPALITIES.

LEWES COUNCIL are obtaining a motor ambulance.

BARKING COUNCIL are raising a fund for purchasing a motor ambulance.

SPENBOROUGH COUNCIL have obtained estimates for the supply of a motor fire engine.

SLEAFORD RURAL COUNCIL propose to purchase a steam motor wagon at a cost of £837.

MONK BRETTON COUNCIL are considering the advisability of obtaining a steam wagon.

BLACKPOOL CORPORATION contemplate purchasing a motor fire engine at a cost of £1,200.

WEYMOUTH COUNCIL have been recommended to purchase an electric wagon at a cost of £1,200.

MANCHESTER CORPORATION have purchased two 4-ton Sentinel steam wagons for the Gas Department.

WHITEHAVEN COUNCIL have asked for sanction to raising a loan for the purchase of a motor fire engine.

MAIDSTONE COUNCIL have applied for sanction to borrow £1,200 for the purchase of a battery-driven wagon.

GREAT CROSBY URBAN COUNCIL have had a nine-year-old Napier touring car converted for use as a fire tender.

WALSALL COUNCIL have refitted a second-hand lorry at a cost of £93, compared with £730 expended on a new vehicle obtained in 1916.

WOOLWICH COUNCIL propose to obtain a Sentinel steam wagon from Messrs. Alley and MacLellan for £1,000 for the removal of ashes.

MORECAMBE COUNCIL are promoting a Bill in the next session of Parliament for power to acquire and work motor omnibuses in the borough and adjoining districts.

HALIFAX COUNCIL have decided to purchase two Ford chassis for the Health Department and one for the Street Cleaning Committee to be used in the removal of house refuse.

SOUTHAMPTON COUNCIL have placed orders for two additional lorries at £863 each, as the help hitherto given by A.S.C. vehicles in hauling road material is no longer available.

CROYDON CORPORATION'S 4-ton electric lorry has effected a saving in haulage charges of about £250 a year, according to a report presented by the manager of the electricity department.

LOSSIEMOUTH COUNCIL are inquiring as to the cost of obtaining an electric lorry, as the interest on a loan of £1,000 would be less than the cost of keeping a horse at the present price of fodder.

IPSWICH COUNCIL have purchased a first-aid fire motor vehicle of 29 H.P., capable of conveying four men, and fitted with equipment enabling one jet to be got to work immediately on arrival at a fire.

SYDNEY (N.S.W.) COUNCIL, owing to the heavy cost of horse cartage, have made an offer to the Public Works Department for the use of a number of steam lorries that the latter are importing in connection with the construction of the city electric railway, which work has been suspended owing to the war.

BY-LAW AGAINST EXCESS PASSENGERS ON OMNIBUSES. –Complaints having been made of overloading motor omnibuses running on the main roads of Northamptonshire, the Roads Committee have reported to the County Council that they are advised the authority have no power to make a by-law against overloading. The committee, however, are conferring with the Home Office with a view to the Secretary of State allowing a by-law to be included amongst by-laws which the Council had power to make for the good rule and government of its area. Certain urban authorities, possessing powers, had made by-laws, but considerable variation existed as to the number of passengers allowed. If it were found practicable for the County Council to deal with the matter, the Urban Councils would be consulted with a view to the adoption of a uniform practice.

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# MOTOR TRAFFIC.

## MOTOR TRAFFIC NOTES.

No Petrol for Omnibuses. West Bridgford Council have been unable to obtain the renewal of the contracts for petrol and paraffin for their omnibuses. Representations have been made to the Ministry of Munitions with a view to securing an extra licence for paraffin.

Austin Commercial Motors.—Owing to the Ministry of Munitions' award to workmen, and the increased cost of materials, the Austin Motor Company notify that they have been obliged to increase the price of their commercial motor chassis to £750, delivered at works, as from December 16.

Glasgow Corporation's Motor Cars.—In view of the difficulties that would be experienced, the Garage Committee of the Corporation have decided not to entertain a request for the free use of their motor cars for conveying on Sunday mornings to the railway stations the voluntary workers at the canteens for soldiers.

The Institution of Automobile Engineers.—At the third meeting of the Institution of Automobile Engineers this session, held at the Royal Society of Arts, John Street, Adelphi, W.C., on December 12, Mr. A. E. L. Chorlton road a paper entitled "The Agricultural Power Unit—some factors governing the design of a small tractor."

London Traffic Facilities.—Mr. Wardle, replying to a question by Major Newman in the House of Commons on November 28, said he understood that the services on the London Underground Railways had not been reduced, but on the contrary had been substantially increased during the war. He regretted that it was not possible at the moment to increase the supply of petrol for omnibuses.

**Dennis War Department Vehicles.**

Omnibus Traffic and the Roads.—The Executive Council of the County Councils Association have adopted a resolution that having regard to the great cost of keeping up the county roads in a fit state for the motor omnibus traffic recently introduced for the profit of the owning companies, legislation should be carried out by the Government for the payment to the highway authorities of a fair mileage rate by the owners of such vehicles.

War Tax on American Motor Vehicles. President Wilson has signed the War Revenue Bill, under the terms of which manufacturers of motor vehicles will be required to pay a tax of 3 per cent. on all machines produced. The tax applies to private cars and motor cycles as well as to commercial vehicles. It will probably be ruled that trucks sold to the Government will be exempt from the tax. Owing to the narrow margin of profit now being made by the majority of the makers, the tax is being passed on to purchasers.

Experimental Air Mail Fleet.—Colonel Mervyn O'Gorman, consulting engineer to the Director-General of Military Aeronautics, and formerly superintendent of the Royal Aircraft Factory, lecturing before the Royal Society of Arts on Wednesday, said that the great air problem would be to bridge the hiatus between the cessation of aeroplane manufacture for war purposes and the starting of a commercial air fleet. The Government should now liberate a few machines and some pilots to initiate a mail and package carrying service.

Military Traffic at Salonika.—The large number of motor vehicles in use by the British and French forces at Salonika has necessitated the construction of many miles of new roads and the conversion of existing tracks to a condition that will bear the traffic. Several steam rollers have been sent out from this country for that purpose, and others are being obtained. Among them is one that the Cumberland County Council have had in use for 27 years. Its cost was less than £400, and it has been sold to the Government for £200.

Motor Ambulances of the British Army.—Sir George Touche, in thanking the subscribers in the city ward of Walbrook for a motor ambulance presented to the Red Cross Society, said that when the war began the British Army had no such thing as a motor ambulance. Some 500 were provided by the Red Cross Society, and the number now exceeded 2,000, in addition to lorries for conveying hospital stores, soup kitchens, and surgical cars. Including all these, the number of Red Cross vehicles was now 3,100. Each ambulance has apparatus capable of bringing up the temperature in the vehicle to 80 degrees.

Commercial Vehicle Tires.—George Spencer, Moulton and Company, Limited, 239, Deansgate, Manchester, have issued their new list, 102, which will be invaluable for reference to owners and agents. It contains a new scale of prices and the buyer can thus more readily estimate his outlay, but exact and detailed quotations, with information about allowances, nearest fitters, etc., will readily be supplied by the head office, Solid Tire Department, Deansgate, Manchester. A feature which will be useful is a list of press owners in all parts of the kingdom, and this compilation should prove specially helpful to those who are not familiar with the facilities. A schedule of loads for each section of tire, the terms of guarantee and sale, and much other information is included.

## DENNIS BROTHERS, LIMITED.

For the year ended September 30 the net profits, including £16,536 brought forward, were £87,406. After placing £15,000 to reserve and £85,000 to reserve for estimated liabilities, a further dividend of 5 per cent. and a bonus of 7½ per cent., making 17½ per cent. for the 12 months, were recommended, and £19,906 carried forward. The net profits for 1915-16 were £120,186, for 1914-15 £147,220, and for 1913-14 £61,484.

At the annual meeting on November 31, in moving the adoption of the report, the chairman, Mr. H. B. Andrews, referred to the strenuous character of the work that the company had had to perform. There had been a continually increasing demand for a greater output of their standard line of manufactures, and the company, by reason of continuous extension of premises, equipment, and means of production generally, had largely succeeded in meeting the demands for more and better vehicles. Since 1913 the working factory space had been doubled. The company had acquired adjoining land which would permit them to treble the present factory space. The directors hoped that all the extensions would be completed during the next few weeks.

### Trade Policy After the War.

They were now in possession of a plant so far ahead of former peace requirements that the position after the war must to a large extent depend on the country's future trade policy. At present they had but one customer, who at very short notice was at liberty to withdraw his custom, but when that happened there would doubtless be an enormous private demand for commercial vehicles. In the meantime users had been compelled to form fresh connections with manufacturers in other countries, who had been at liberty to develop their models to suit the public demand, whereas national needs had confined this company to one model only, their fire engine alone excepted. The Americans, who would be their chief competitors, have as a basis a huge protected market, and they were no longer under the disadvantage of such a disparity in wages as existed a few years ago. Nevertheless, the directors had full confidence in their ability to find adequate outlets for the company's increased production.

Mr. H. R. Dennis (a managing director), in seconding, said that a year ago he expressed the hope that the increased output from the extensions would counteract the ever-increasing expense of material and labour, and although the extensions were not all completed, this forecast had come true. They had not charged the Government more for their manufacture; the price charged to-day was the same as at the outbreak of war, and all the increased expenses had been met by labour-saving appliances and a greater output. The fire engine department had shown its relative proportion in the increased output. The Dennis turbine engine stood pre-eminent of all fire-fighting appliances. It protected against fire the principal cities of the world and played a great part in protecting life and property against incendiary bombs. It was very pleasing for the directors to look back for the past three years and say that they had had no trouble with their workpeople.

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THE TRAMWAY AND RAILWAY WORLD.
(REGISTERED AS A NEWSPAPER.)
FOUNDED, 1892.

PRICE ONE SHILLING

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WITH
"MOTOR TRAFFIC" SECTION

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Offices: AMBERLEY HOUSE, NORFOLK STREET, LONDON, W.C.2
Telegrams, "TRAMIGRO, LONDON."
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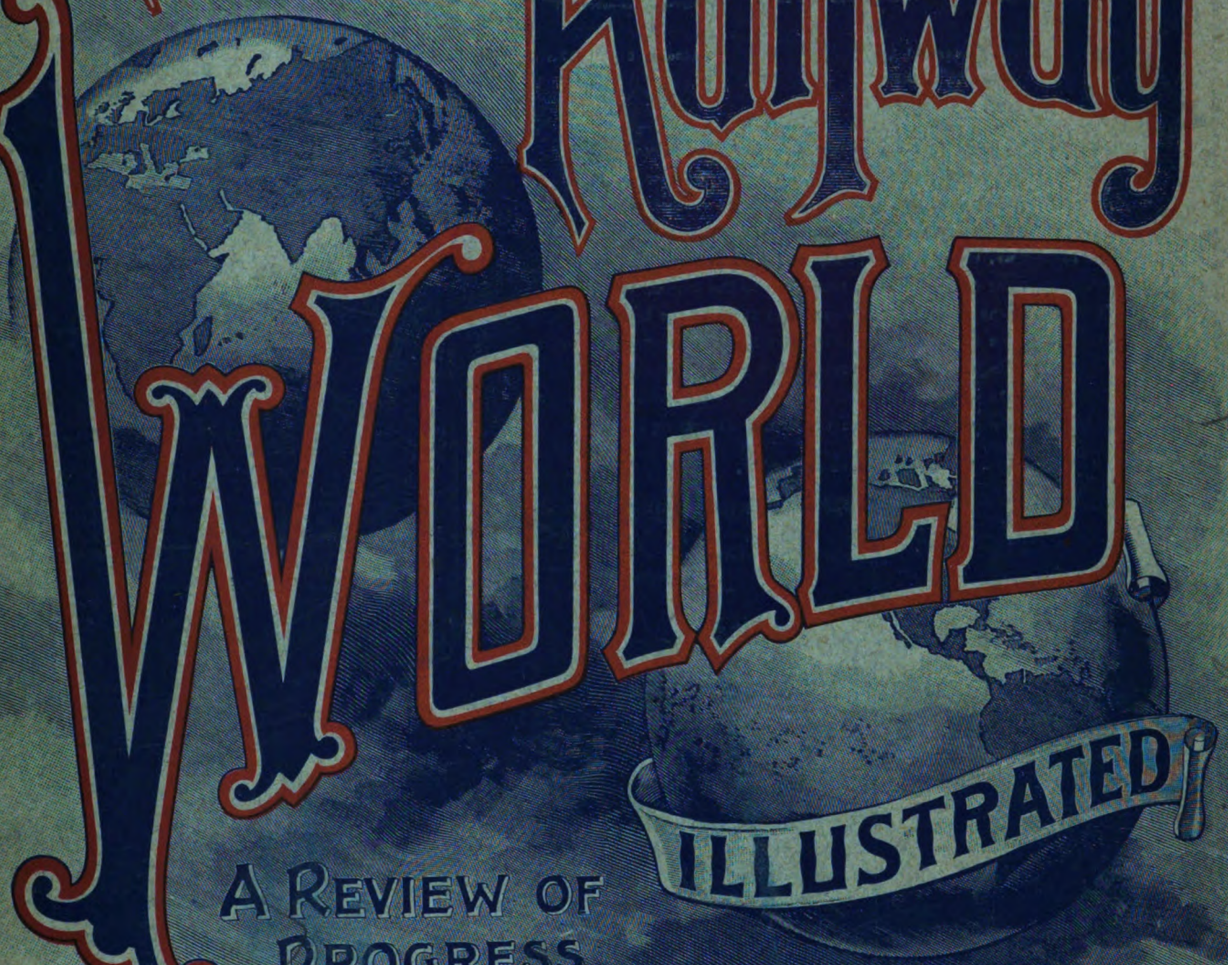
# The Tramway and Railway World




A REVIEW OF PROGRESS IN Electric AND OTHER Traction.

TPB
Vol 42
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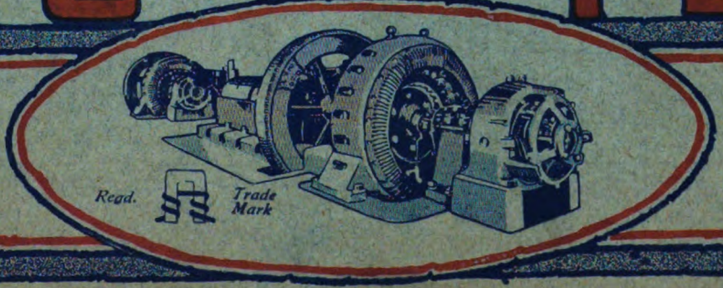
G-E-C-Electrical PLANT

The Alternators illustrated are driven by horizontal internal combustion engines. Good parallel running is successfully attained in spite of the difficulties due to this form of drive.

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THE WORCESTER MOTOR ENGINEERING Co

W. T. THORNE

*The Butts Garage*

WORCESTER

MAGNETO AND LIGHTING SET EXPERT

TELEPHONE 368
TELEGRAMS
THORNE GARAGE WORCESTER

To Messrs C.A. Vandervell Ltd.
Acton Vale, LONDON.

January 8th. 1917.

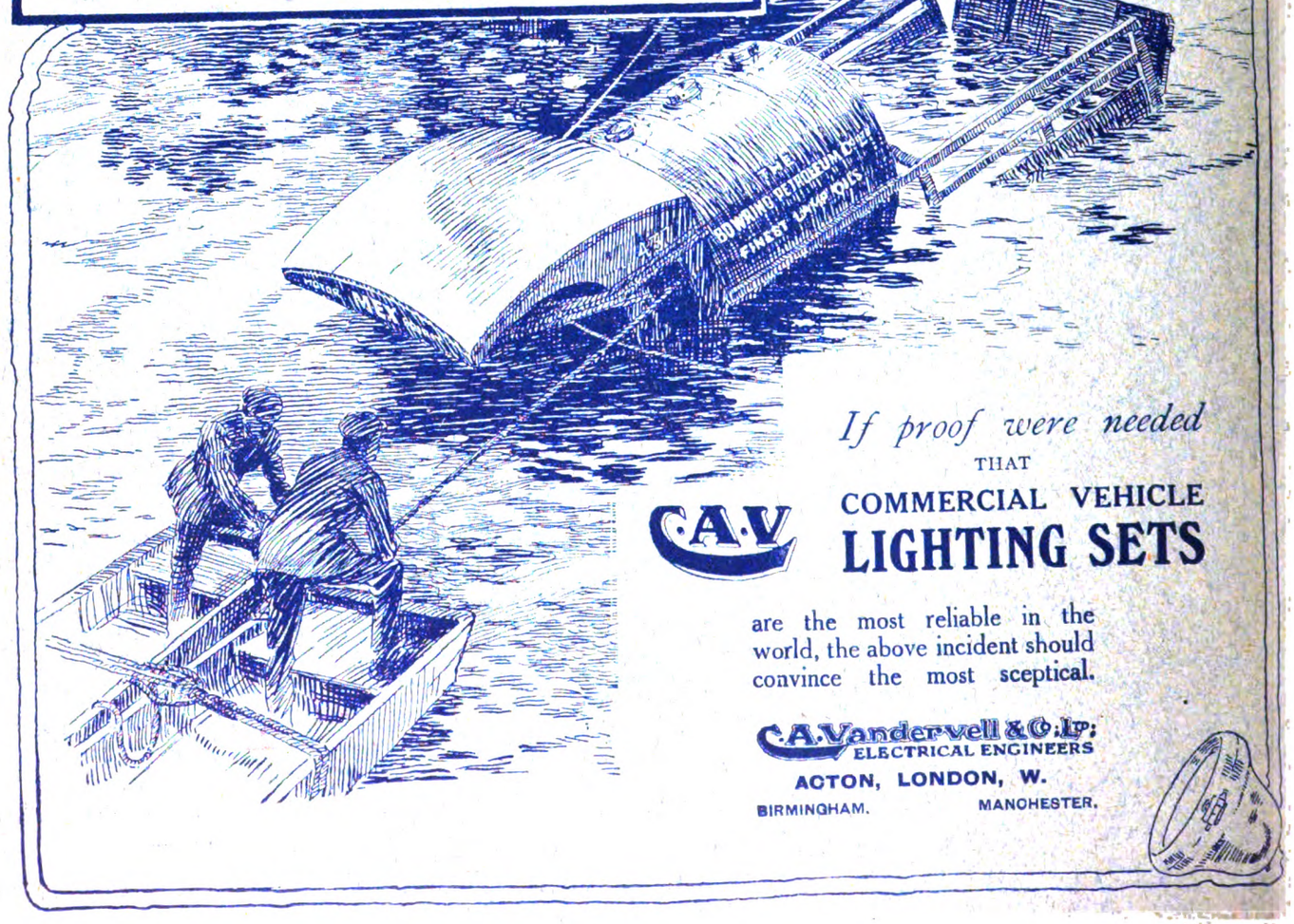
Gentlemen,

I thought that the following might be of interest to you, and think it only fair to tell you. A Motor lorry belonging to the Bowring Petroleum Coy. Ltd. recently skidded and crashed through the railings of Bransford bridge near Worcester, and fell about 25 feet into the River Teme, where it lay totally submerged in 12 to 14 feet of water for three days.. We were instructed by the Company to get the lorry out of the river, and when we hauled it on to the bank, I switched on the electric lights, and every light lit perfectly. This was one of your C.A.V. Lighting Sets, and a crowd of nearly three thousand people witnessed this, much to everyone's surprise. I am with your permission going to write to the "Motor" describing this.

Yours faithfully,

THE WORCESTER MOTOR ENGINEERING COMPANY,

William T. Thorne




*If proof were needed*

THAT

COMMERCIAL VEHICLE

**LIGHTING SETS**

are the most reliable in the world, the above incident should convince the most sceptical.

C.A.V.

C.A. Vandervell & Co. Ltd.
ELECTRICAL ENGINEERS
ACTON, LONDON, W.
BIRMINGHAM. MANCHESTER.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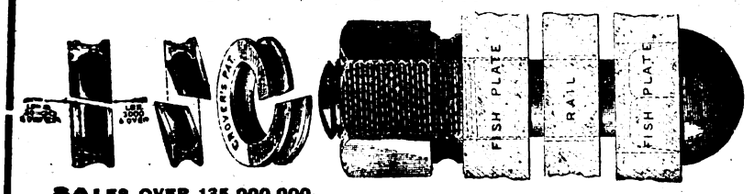


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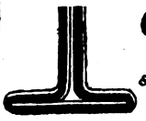

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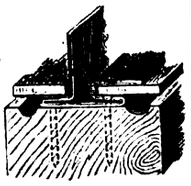

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May we send you some specimens? We produce tickets in any style, in any quantity, and print in any language.

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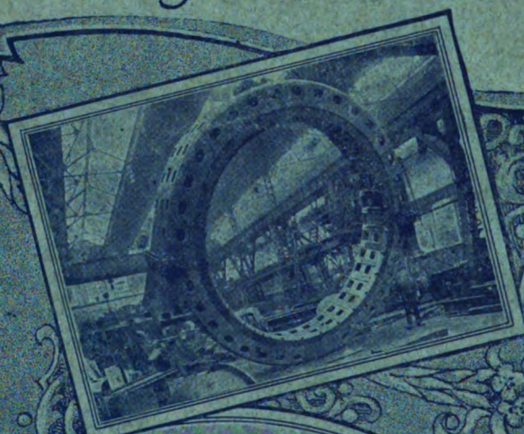
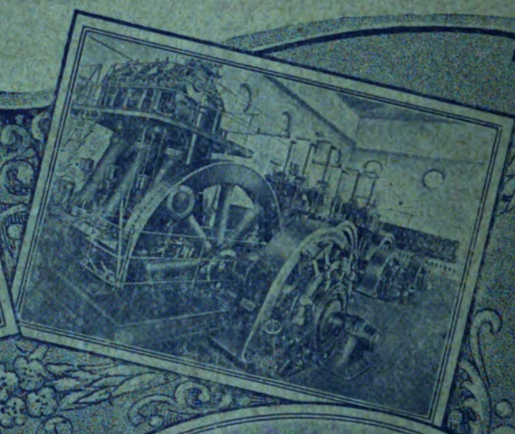

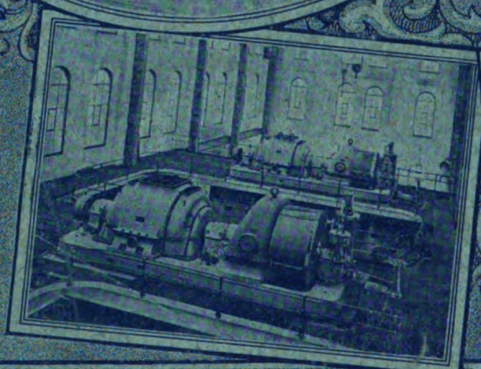

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# The Tramway and Railway World

ILLUSTRATED

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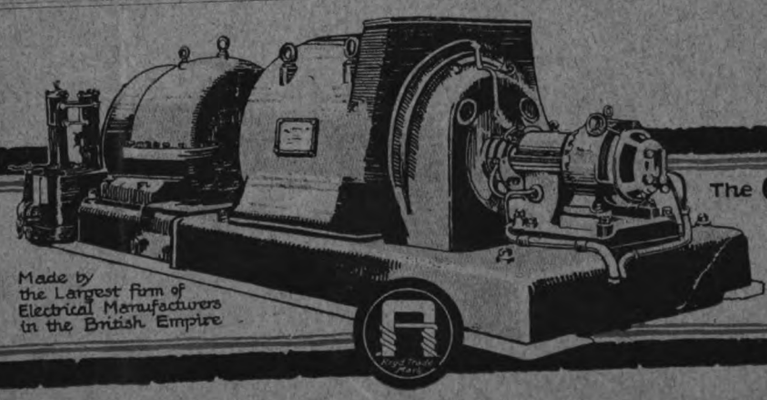

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The General Electric Company Ltd.
Principal Showrooms and Sales Depôt
Queen Victoria St.
LONDON

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*A remarkable photograph portraying six of the London General Omnibus Company's country service fleet, equipped with C.A.V. "H" type installations, obtained by an exposure lasting from 12 midnight until 3 a.m. during November of 1914. The batteries alone furnish current without assistance from the dynamo, and this, after service with lights on from 4.45 p.m. of the previous evening, emphasising the large reserve held by the batteries. Upwards of 2,000 vehicles belonging to the London General Omnibus Company's Fleet now have these equipments. Several other motor omnibus concerns are also using them, and vehicles in France are also equipped.*

*The all-Important feature in C.A.V. lighting equipments is the dynamo, which is so designed that it is reversible without changing over gear or switches whatever, and gives the same output whichever way it is driven—an important feature for all road vehicles.*

**Extract from the "Railway News," 6th January, 1917.**

*Please address enquiries to Commercial Vehicle Dept.*

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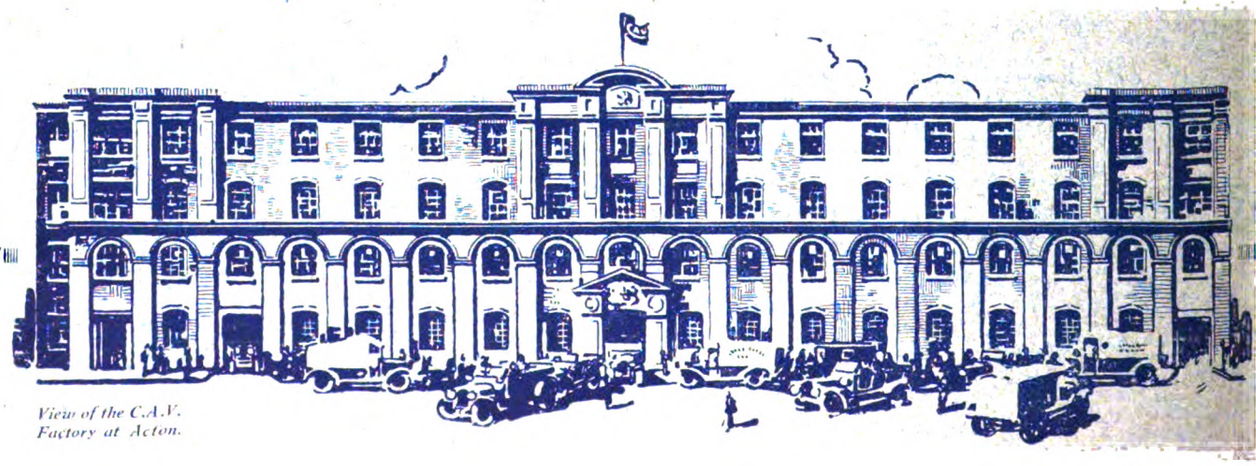

*View of the C.A.V. Factory at Acton.*

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FOUNDED, 1892.

PRICE ONE SHILLING

SEPTEMBER 13, 1917
Vol. XLII., No. 13
WITH
"MOTOR TRAFFIC" SECTION

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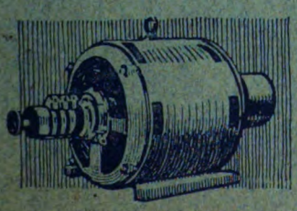

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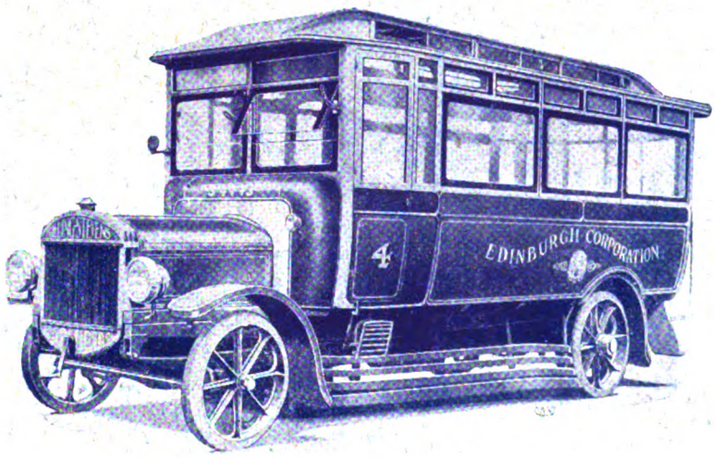


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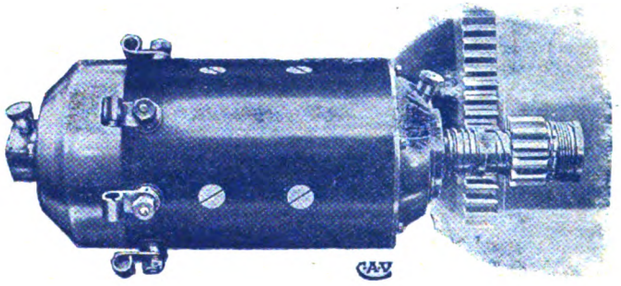

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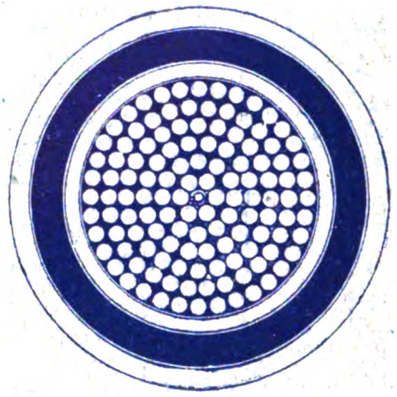

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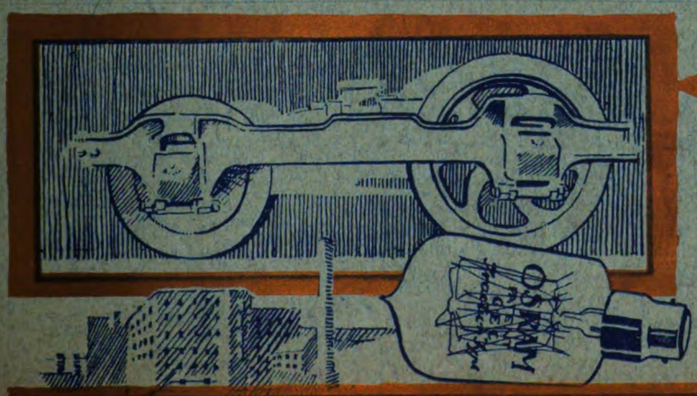

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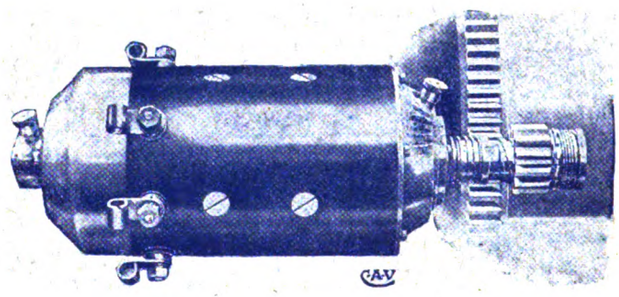

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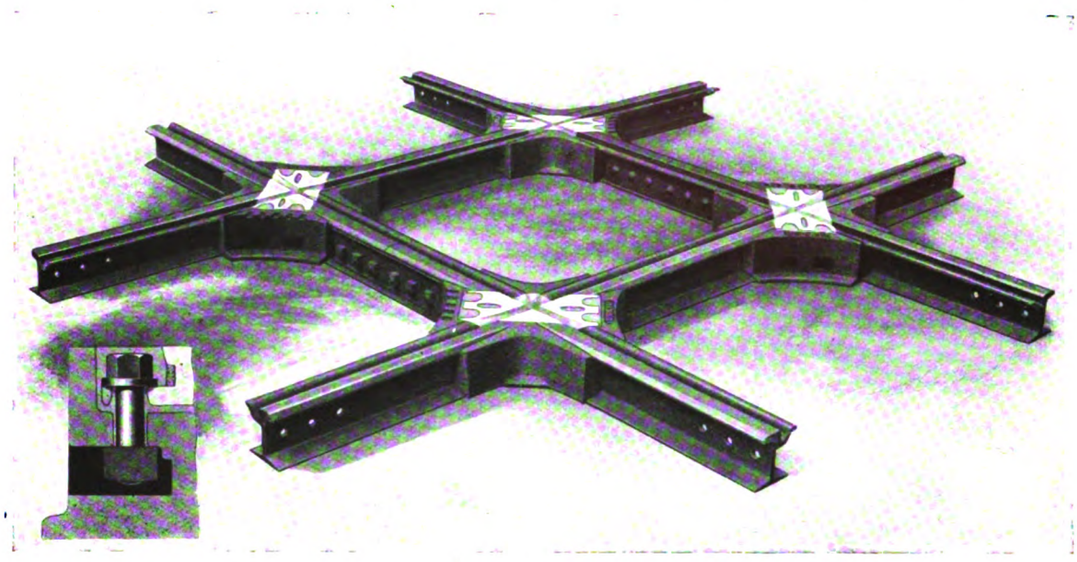

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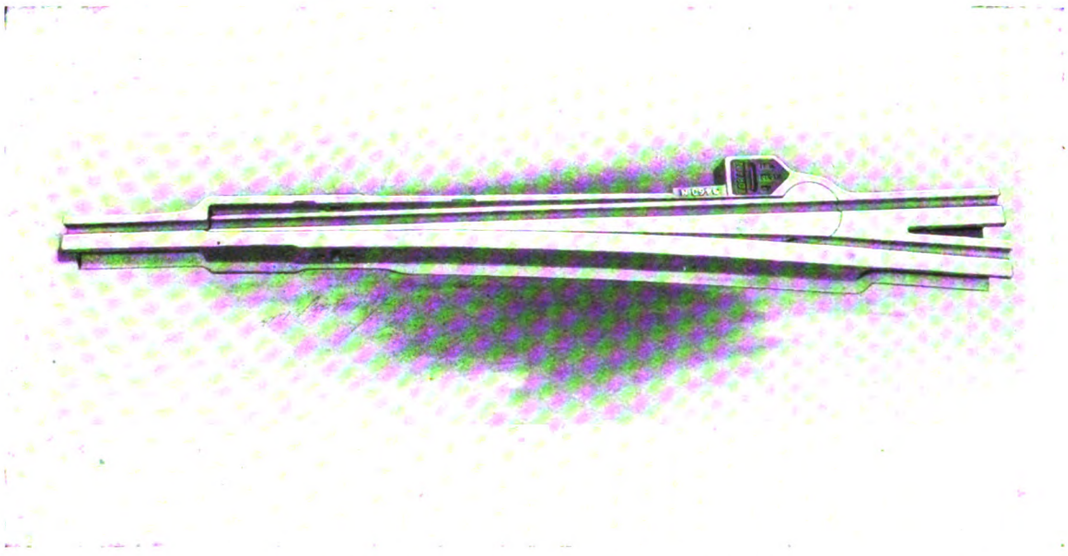

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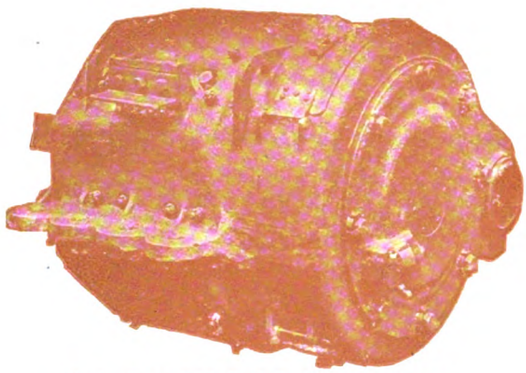
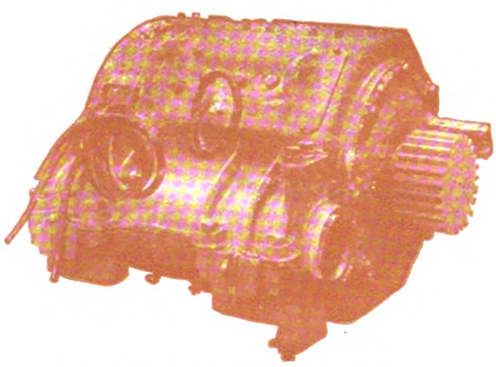


Dick, Kerr 250 B.H.P. Railway Motor, view from commutator end.



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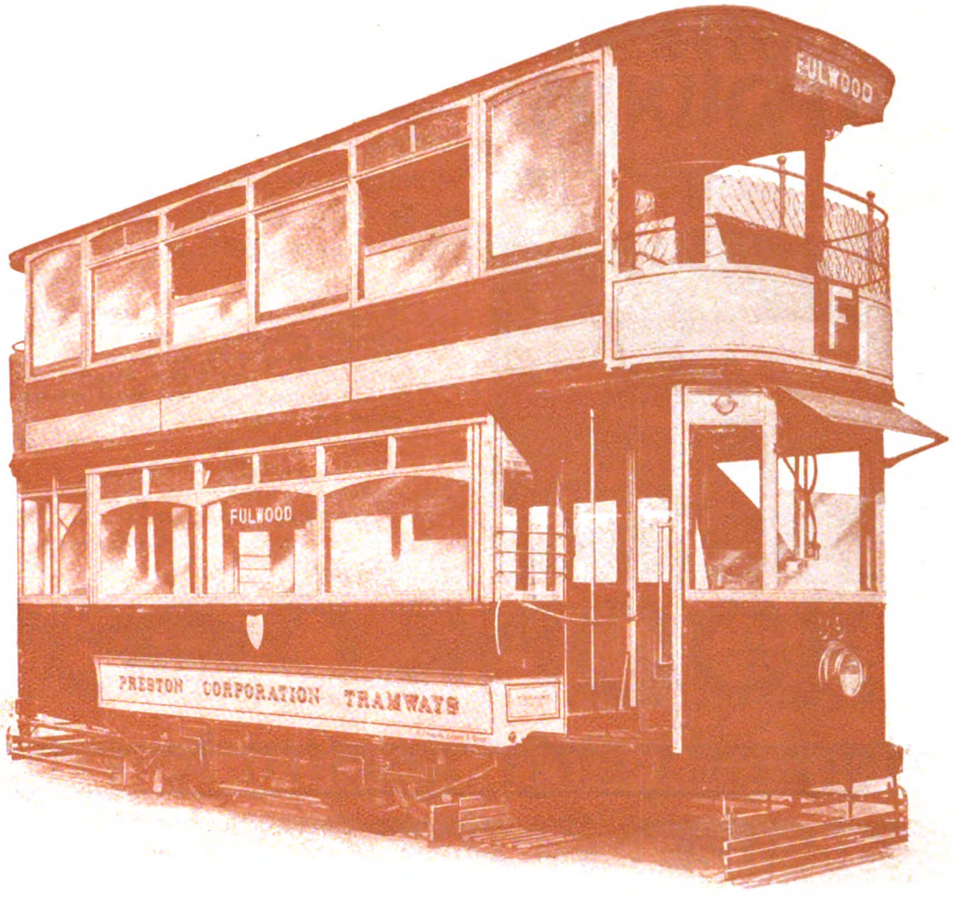


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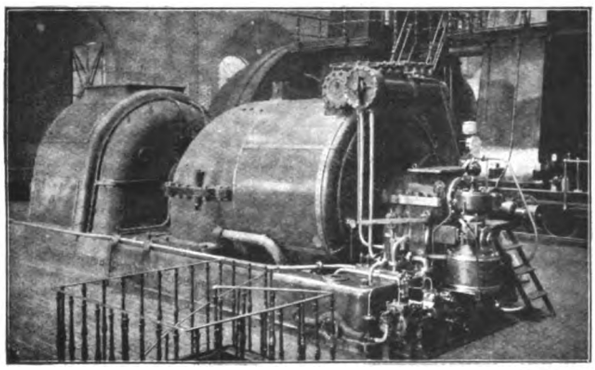

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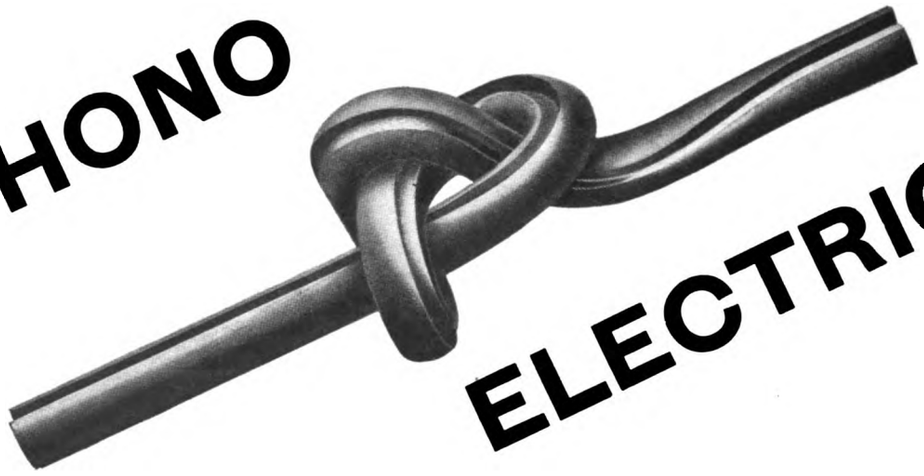

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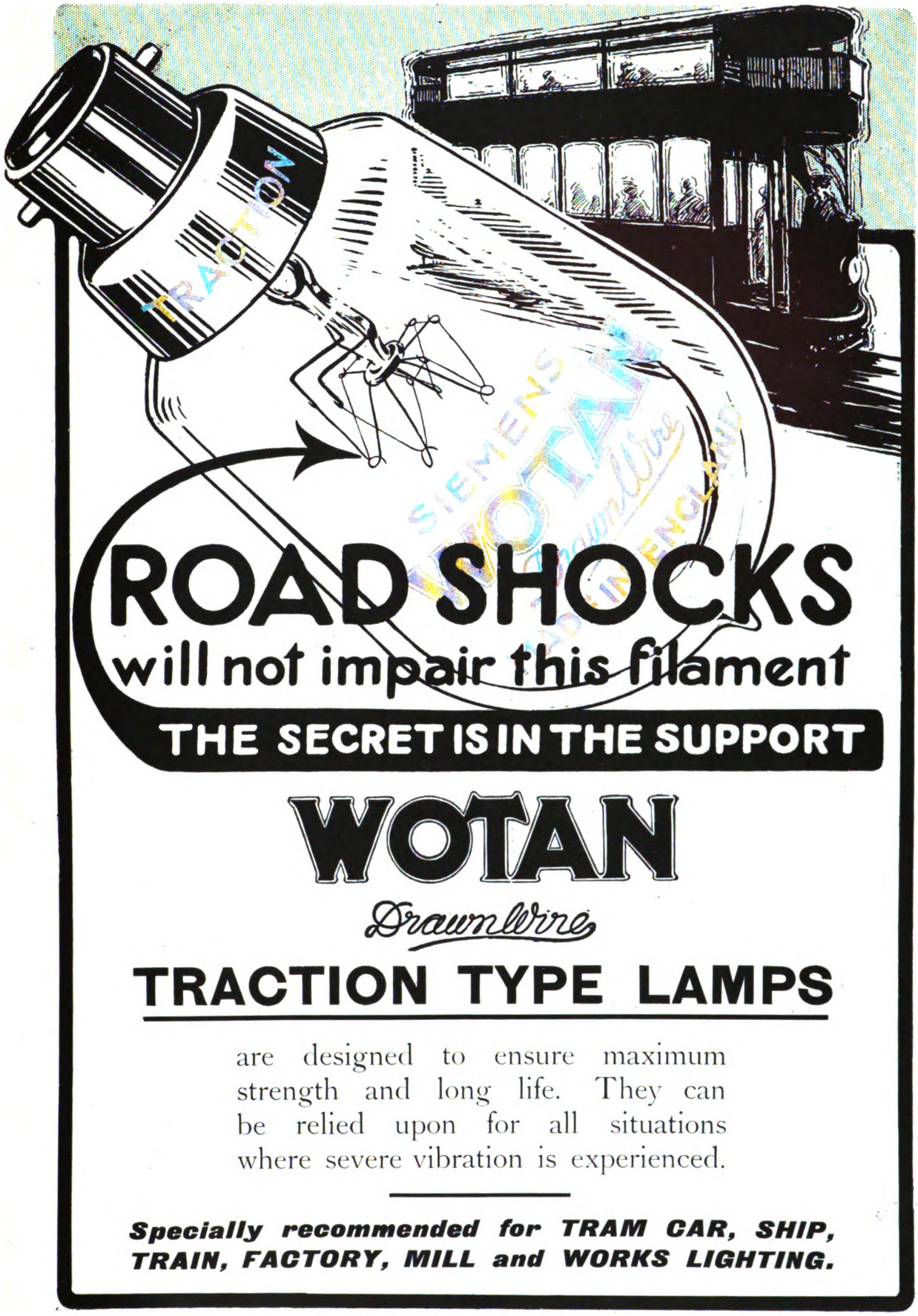


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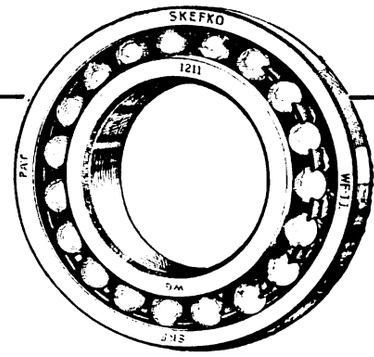

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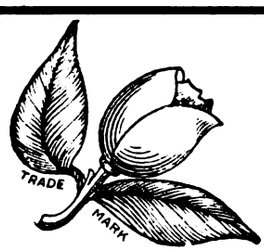


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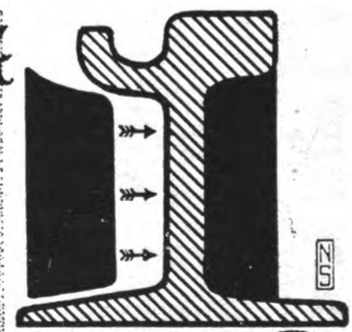

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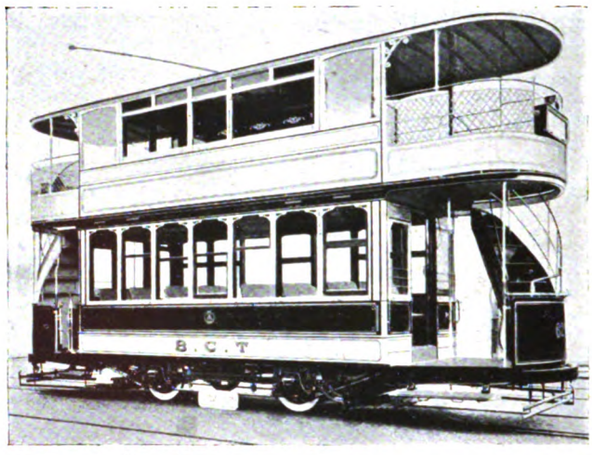


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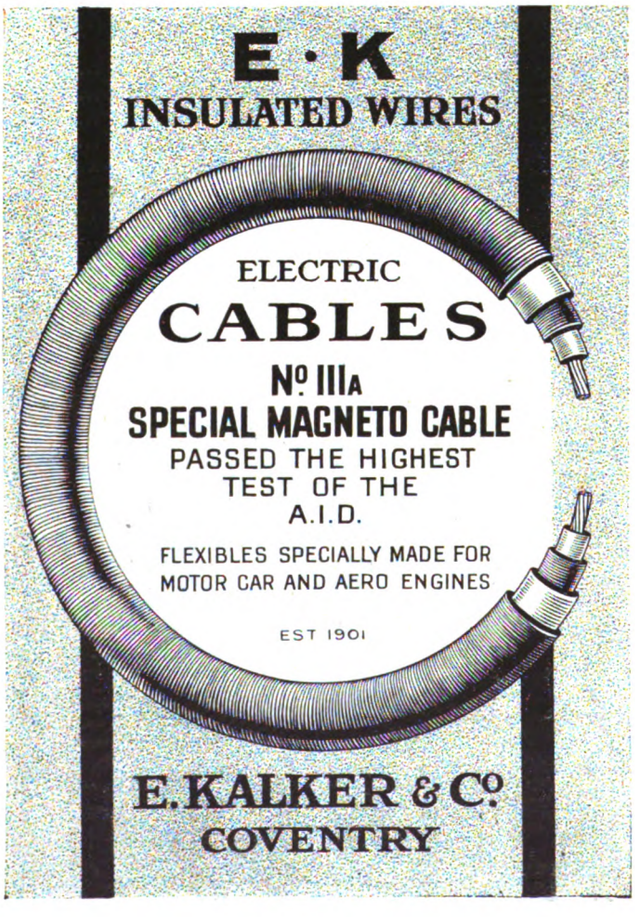


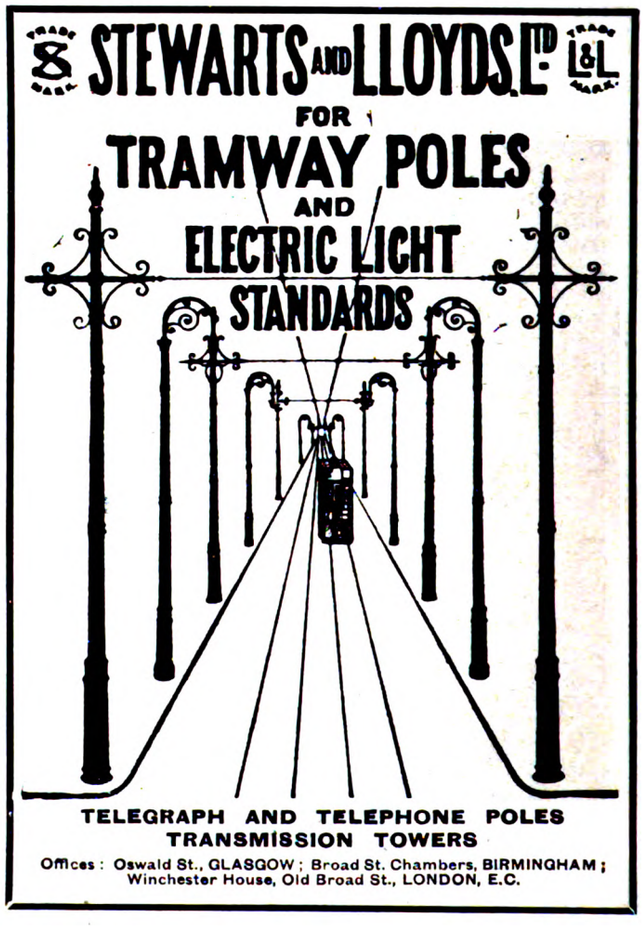



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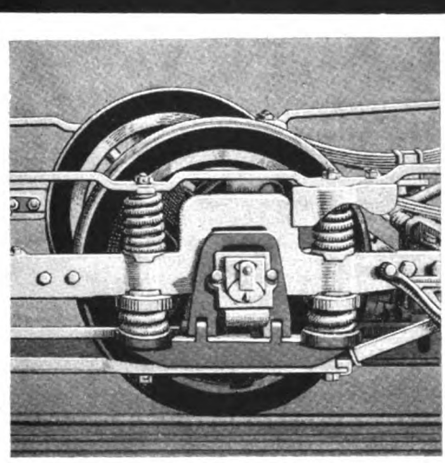

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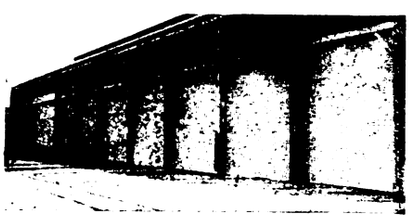

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(*Continued on page xx.*)

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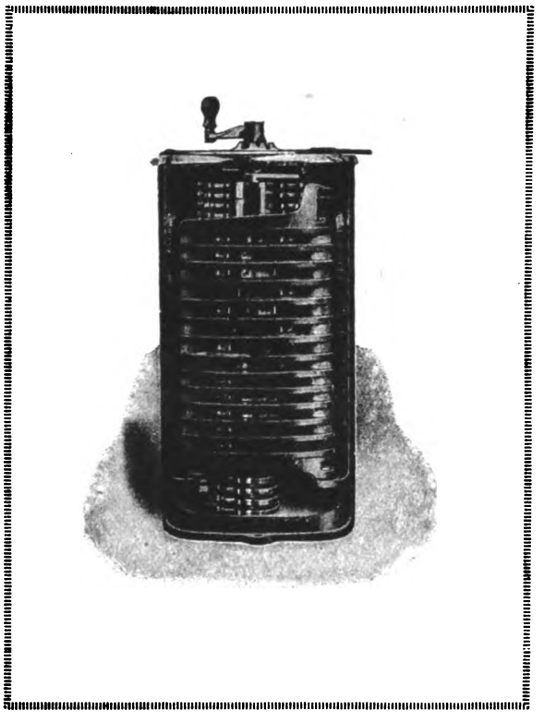

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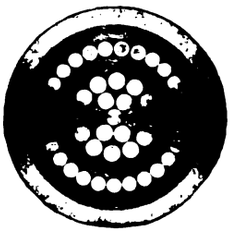

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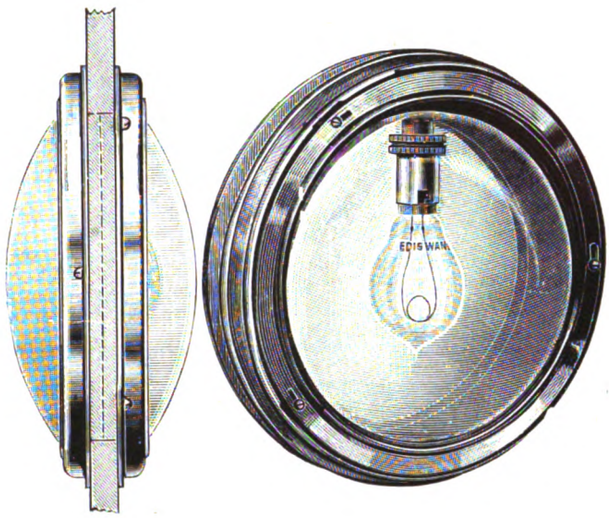


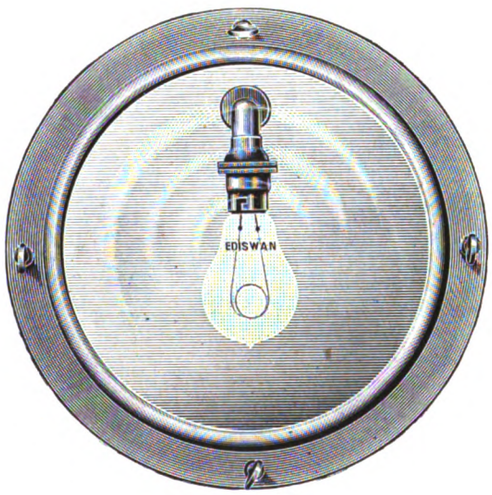

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**MUNICIPAL TRAMWAYS, pp. xxiii-xxiv. COMPANY TRAMWAYS, pp. xxiv-xxvi. PARTICULARS OF TRACK AND EQUIPMENT, pp. xxvii-xxx.**

**TRAMWAY ASSOCIATIONS, p. xxvi.**

**Aberdare Urban District Tramways,** Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare: T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

**Aberdeen Corporation Tramways,** Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen: T.N. 826.] *Gen. Manager and Eng.*, R. S. Pilcher; *Per. Way Eng.*, J. Gordon (*Burgh Surveyor*); *Chairman Try. Com.*, Coun. Robertson.

**Accrington Corporation Tramways,** Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 2212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. Morley.

**Ashton-under-Lyne Corporation Tramways,** Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Ernest Holt; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Ald. R. S. Oldham; *Vice-Chairman*, Ald. Waterhouse.

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**Barking Town Urban District Tramways,** East Street, Barking. [T.N., 156 East Ham.] *Eng. and Manager*, W. Holmes; *Acting Engineer and Manager*, W. E. Kidner; *Chairman Try. Com.*, Coun. D. Gordon.

**Barton-upon-Irwell District Council Light Railways,** Barton-upon-Irwell.

[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

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**Birmingham Corporation Tramways,** The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *City Elec. Eng.*, R. A. Chattock; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Rolling Stock Supt.*, R. H. Dickinson; *Chairman Try. Com.*, Coun. H. Barrow, J.P.

**Blackburn Corporation Tramways,** Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 547.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, E. Greek; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. W. Thompson; *Vice-Chairman*, Coun. C. Higham.

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**Bolton Corporation Tramways,** Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Coun. P. Higson; *Vice-Chairman*, Coun. J. R. Horrocks.

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**Bournemouth Corporation Tramways,** Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, G. F. Glass; *Chairman Try. Com.*, Coun. Bell; *Vice-Chairman*, Coun. McCabe.

**Bradford Corporation Tramways,** Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, C. J. Spencer; *Asst. Elec. Eng.*, J. W. Dawson; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Coun. Enoch Priestley; *Vice-Chairman*, Coun. I. F. Akeroyd.

**Brighton Corporation Tramways,** Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Coun. T. J. Braybon.

**Burnley Corporation Tramways,** Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. Irving.

**Burton-on-Trent Corporation Tramways,** Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland (Deputy Mayor); *Vice-Chairman*, Ald. Lowe.

**Bury Corporation Tramways,** Market Place, Bury. [T.N., 26.] *Gen. Manager*, William Clough; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge; *Vice-Chairman*, Coun. Hargreaves.

**Cardiff Corporation Tramways,** Central Offices, The Hayes, Cardiff. [T.A., Tramways, Cardiff; T.N., 1211, 1240, 1350, and 577.] *Gen. Manager and Elec. Eng.*, A. Ellis; *Deputy Manager*, C. G. M. New; *Traffic Manager*, H. David; *Per. Way Eng.*, ——; *Rolling Stock Supt.*, Jas. Preston; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P.; *Vice-Chairman*, Coun. A. J. A. Stone.

**Chester Corporation Tramways,** Station Road, Chester. [T.N., 166.] *Traffic Supt.*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

**Chesterfield Corporation Tramways,** Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager and Elec. Eng.*, R. L. Acland; *Traffic Manager*, F. Root; *Per. Way Eng.*, C. E. Crossley; *Chairman Try. Com.*, Ald. E. Shentall (Mayor); *Vice-Chairman*, Coun. Woodhead.

**Colchester Corporation Tramways,** Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. A. M. Jarmin (Mayor); *Vice-Chairman*, Coun. Wright.

**Colne Corporation Tramways,** Colne, Lancashire. *General Manager and Engineer*, T. G. Richardson; *Chairman Try. Com.*, Coun. R. Knight (Deputy Mayor); *Vice-Chairman*, Ald. Carr (Mayor).

**Coventry Corporation Tramways,** Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Assistant Engineer*, W. M. Milnes; *Chairman*, Coun. H. W. Wale; *Vice-Chairman*, Coun. J. Grant.

**Croydon Corporation Tramways,** Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Coun. A. A. Thomson; *Vice-Chairman*, Ald. G. J. Allen.

**Darlington Corporation Tramways,** Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2435.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*, Ald. Sir C. W. Starmer.

**Dartford Urban District Council Tramways,** Dartford. *Chairman Try. Com.*, Coun. R. Bennett; *Vice-Chairman*, Coun. W. J. Bourne.

[Leased. See Dartford Tramways in list of Tramway Companies.]

**Darwen Corporation Tramways,** Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, F. J. S. Hosken; *Boro. Elec. Eng.*, C. H. Garnett; *Chairman Try. Com.*, Coun. Geo. Pickup; *Vice-Chairman*, Coun. Butterworth.

**Derby Corporation Tramways,** 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. J. Dean.

**Doncaster Corporation Tramways,** Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager & Elec. Eng. (pro tem)*, G. Roberts; *Chairman Try. Com.*, Coun. S. Balmforth; *Vice-Chairman*, Coun. H. M. Marshall.

**Dover Corporation Tramways,** Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. Carden; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick; *Vice-Chairman*, Coun. Norman.

**Dundee Corporation Tramways,** Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, Peter Fisher; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, Bailie Buist.

**East Ham (County Borough of) Corporation Tramways,** Nelson Street, East Ham. [T.N., 611 and 100, East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Ald. M. Oakes.

**Eccles Corporation Tramways,** Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Coun. Alexander; *Vice-Chairman*, Ald. Pearson.

[Lines worked by Salford Corporation.]

**Erith Urban District Council Tramways,** Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. G. C. Humphreys.

**Exeter Corporation Tramways,** Paris Street, Exeter. *Manager*, R. O. Baldwin; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Ald. H. B. Varwell; *Vice-Chairman*, Coun. F. G. Towill.

**Farnworth Urban District Council Tramways,** Albert Road, Farnworth. *Chairman Try. Com.*, Coun. S. C. Steele; *Vice-Chairman*, Coun. Stanley.

[Lines leased to the South Lancashire Tramways Co.]

**Glasgow Corporation Tramways,** 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Traffic Supt.*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec.*, J. N. Wilson; *Chairman Try. Com.*, Coun. Montgomery; *Vice-Chairman*, Coun. Kelly.

**Gloucester Corporation Light Railway,** Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

**Great Yarmouth Corporation Tramways,** Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Coun. J. T. C. Salmon.

**Halifax Corporation Tramways,** Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

**Haslingden Corporation Tramways,** John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

**Herne Bay Pier Tramway** (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dufton.

**Heywood Corporation Tramways,** Heywood, Lancs. [T.N., 47.] *Gen. Manager*, D. H. Davies; *Per. Way Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Ald. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

**Huddersfield Corporation Tramways,** Northumberland Street, Huddersfield. [T.N., 698 and 898.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Assist. Engineer*, A. P. Quilliam; *Traffic Supt.*, T. Hartley; *Borough Eng.*, K. F. Campbell; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

**Hull Corporation Tramways,** Alfred Gelder Street, Hull. [T.N., 444, Corporation.] *Manager*, Wm. J. McCombe; *Try. Elec. Eng.*, J. Wilkinson [T.N. 443, Corporation]; *Per. Way Eng.*, F. W. Bricknell (*City Engineer*) [T.N. 943, Corporation]; *Chairman Try. Com.*, Coun. W. Hakes; *Vice-Chairman*, Coun. C. Raine.

**Ilford Urban District Council Tramways,** Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. O. Waters; *Vice-Chairman*, Coun. J. Lowe.

**Ilkeston Corporation Tramways,** Park Road, Ilkeston. *Chairman Try. Com.*, Coun. J. E. Bestwick; *Vice-Chairman*, Coun. Kane.

[These tramways have been sold to the Tramways, Light and Power Co., Ltd.]

**Ipswich Corporation Tramways,** Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome; *Vice-Chairman*, W. Reavel.

**Kearsley Urban District Council Tramways,** Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

**Keighley Corporation Tramways,** South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

**Kilmarnock Corporation Tramways** Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng and Manager*, W. C. Bexon; *Consulting Engineers* Kennedy and Jenkin; *Convener Try. Com.*, Cou McMenan.



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# ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

**Kirkcaldy Corporation Tramways,** Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

**Lancaster Corporation Tramways,** Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Acting Boro. Electrical Engineer and Tramways Manager*, J. B. Patterson; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

**Leeds City Tramways,** Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 1230; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Highways and Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

**Leicester Corporation Tramways,** 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Boro. Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

**Leith Corporation Tramways,** 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Bailie Goalen.

**Leyton District Council Tramways,** Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. F. M. Read.

**Lincoln Corporation Tramways,** Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White.

**Liverpool Corporation Tramways,** 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *City Electrical Engineer*, Harold Dickinson; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Ald. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

**London County Council Tramways,** 23, Belvedere Road, Lambeth, London, S.E.1. [T.A., Lotram Ave., London; T.N., 4385 Hop] *General Manager*, A. L. C. Fell; *Traffic Manager*, J. K. Bruce; *Electrical Engineer*, P. L. Riviere; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Development Supt.*, T. E. Thomas; *Chairman Highways Com.*, G. H. Hume; *Vice-Chairman*, A. H. Scott, J.P.

**Lowestoft Corporation Tramways,** Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett (Mayor).

**Maidstone Corporation Tramways,** Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Ald. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

**Manchester Corporation Tramways,** 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

**Middlesex County Council Light Railways,** Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Coun. F. Goodyear.

**Middleton Corporation Tramways.** *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Ald. W. Wood, J.P. (Mayor); *Vice-Chairman*, Ald. Bentley, J.P.

[Worked by Manchester Corporation Tramways.]

**Nelson Corporation Light Railways,** Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

**Newcastle-upon-Tyne Corporation Tramways,** Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland.

**Newport (Mon.) Corporation Tramways,** Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

**Northampton Corporation Tramways,** St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

**Nottingham Corporation Tramways,** Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

**Oldham Corporation Tramways,** Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, P. Priestly; *Traffic Supt.*, J. Brierley; *Chairman Try. Com.*, Coun. Cheetham; *Vice-Chairman*, Coun. Stanbury.

**Perth Corporation Tramways,** 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

**Plymouth Corporation Tramways,** 71 & 72, Old Town Street, Plymouth. [T.N. 518, Plymouth.] *Gen. Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. S. H. Phillips, J.P.; *Vice-Chairman*, Coun. J. Moon.

**Pontypridd Urban District Tramways,** Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

**Portsmouth Corporation Tramways,** Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

**Preston Corporation Tramways,** Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Assistant Manager and Engineer*, H. Clayton; *Traffic Supt.*, C. H. Manning; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

**Radcliffe Urban District Council Tramways,** Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Lund.

[These tramways are worked as part of the Bury system.]

**Rawtenstall Corporation Tramways,** Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

**Reading Corporation Tramways,** Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P.

**Rochdale Corporation Tramways,** Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. S. Platt; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

**Rotherham Corporation Tramways,** Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. R. Lilleker; *Traffic Superintendent*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

**St. Helens Corporation Tramways,** Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Coun. G. P. Varley; *Vice-Chairman*, Coun. W. Pilkington.

[Lines worked by the New St. Helens and District Tramways Co.]

**Salford Corporation Tramways,** 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

**Sheffield Corporation Tramways,** 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Traffic Supt.*, A. Handford; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. and Motors Com.*, Ald. Sir W. E. Clegg, J.P.; *Vice-Chairman*, Ald. W. C. Fenton. J.P.

**Shipley Urban District Tramway,** Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, H. Pitts.

[Lines leased to Bradford Corporation.]

**Southampton Corporation Tramways,** 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

**Southend-on-Sea Corporation Tramways,** London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. T. Fayle; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Coun. G. Radford.

**Southend Pier Electric Railway,** (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

**Southport Corporation Tramway,** 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Coun. Clayton; *Vice-Chairman*, Coun. Richardson.

**South Shields Corporation Tramways,** Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie.

**Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board,** Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

**Stockport Corporation Tramways,** Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hamnett.

**Sunderland Corporation Tramways,** Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Ald. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

**Swindon Corporation Tramways,** Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. Stevens; *Vice-Chairman*, Coun. Horder.

**Wallasey Corporation Tramways,** Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1481, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

**Walsall Corporation Tramway,** St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

**Walthamstow Urban District Council Tramways,** Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke.

**Warrington Corporation Tramways,** Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Ald. J. Wilkinson.

**West Bromwich Corporation Tramway,** Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Highways Com.*, Ald. A. G. Turley, J.P.; *Vice-Chairman*, Coun. G. Garrett.

[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

**West Ham Corporation Tramways,** Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 868 East.] *General Manager*, L. Slattery; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, Coun. Kensett.

**West Hartlepool Corporation Tramways,** Cleveland Road, West Hartlepool. [T.N., 6078.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

**Wigan Corporation Tramways,** Market Place, Wigan; [T.N., 226.] *Gen. Manager*, F. Buckley; *Per. Way Eng.*, A. T. Gooseman; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Coun. J. Walkden.

**Wolverhampton Corporation Tramways,** Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

**York Corporation Tramways,** 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

# COMPANY TRAMWAYS.

**Aberdeen Suburban Tramways Company,** 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, W. Jackson, Dr. Christie, Jas. Sellar.

**Airdrie and Coatbridge Tramways Company,** Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Manchester Hotel, London, E.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

**Barnsley and District Electric Traction Company, Ltd.,** Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Acting Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

**Barrow-in-Furness Tramways,** Salthouse Road Depot, Barrow, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, J. Dobson; *Sec.*, F. J. Cursons; *Acting Sec.*, J. S. Bowker; *Chairman*, H. S. Day; *Directors*, J. V. Kitchener, E. R. Soames.

**Bath Electric Tramways Company, Ltd.,** Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

**Bessbrook and Newry Tramway Company,** Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, M. Hamilton; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, T. McGreggor Greer.

**Birmingham District Power and Traction Company,** Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton *Directors*, J. A. Lycett, W. L. Madgen, S. R Blundstone, R. J. Howley.

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# ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

**Blackpool and Fleetwood Tramroad Company, Ltd.,** Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

**Blackpool and Fylde Light Railway Company,** 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

**Blackpool, St. Anne's, and Lytham Tramways Company, Ltd.,** Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 22]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

**Bray and Enniskerry Railway Company,** 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

**Brighton Beach Electric Railway,** Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

**Bristol Tramways and Carriage Company, Ltd.,** Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, W. H. Stradling; *Electrical Engineer*, ——; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, J.P., Sir G. Stanley White, Bart., S. E. Baker.

**British Electric Traction Company, Ltd.,** Electrical Federation Offices, Manchester Hotel, London, E.C. E. Garcke (*chairman*); *Directors*, C. Shirreff, B. Hilton, W. L. Madgen, Sir Charles Ollivant, A. Shepherd, G. T. Symons, C. G. Tegetmeier, P. D. Tuckett; *Joint Managers*, C. H. Dade and R. J. Howley; *Acting Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.:
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Middleton.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
South Metropolitan.
Southport.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

**Burton and Ashby Light Railways,** Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

**Camborne and Redruth Tramways,** Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Douglas Owen.

**Carlisle Tramways Company, Ltd., City of,** Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, R. L. McCulloch.

**Chatham and District Light Railways Company,** Luton Road, Chatham, and 83, Cannon Street London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Traffic Manager*, ——; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

**Cheltenham and District Light Railway Company,** Cheltenham. [T.N., 341.] *Directors*, A. H. Beatty (*Chairman*), W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C. A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, St. George's Road, Cheltenham.

**Clontarf and Hill of Howth Tramroad Company,** 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

**Cork Electric Tramways and Lighting Company, Ltd.,** Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, Capt. W. Martindale, H. C. Levis.

**Dartford Urban District Council Light Railways.** Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Bexley Urban District Council, Broadway, Bexleyheath, Kent).

**Devonport and District Tramways Company,** Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[The Company's undertaking has been sold to Plymouth Corporation.]

**Dewsbury, Batley, and Birstall Tramways Company, Ltd.,** Electrical Federation Offices, Manchester Hotel, London, E.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

**Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways,** (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

**Douglas—Ramsey. (The Manx Elec. Rly. Company),** 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

**Douglas Southern Electric Tramways, Ltd.,** Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

**Dublin and Lucan Electric Railway Company,** 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, A. B. Coyle, J.P., G. N. Murphy.

**Dublin United Tramways Company (1896), Ltd.,** 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy, J.P.; *Directors*, Joseph Mooney, J.P., Rt. Hon. L. A. Waldron, P.C., William Hewat.

**Dudley, Stourbridge and District Electric Traction Company, Ltd.** (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley.

**Dumbarton Burgh and County Tramways Company,** Tramway Depot, Dumbarton, and 28, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, A. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

**Dundee, Broughty Ferry & District Tramways Company,** Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

**Dunfermline and District Tramways Company,** Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

**Falkirk & District Tramways Company,** Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

**Felixstowe Pier Railway,** Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

**Gateshead and District Tramways Company,** Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, Judge L. A. Atherley-Jones, K.C.

**Giant's Causeway and Portrush Electric Tramway Company,** Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, F. J. S. Moore; *Directors*, C. M'D. Stuart, W. A. Traill.

**Glossop Tramways,** Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

**Gosport and Fareham Tramways,** Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

**Gravesend & Northfleet Electric Tramways, Ltd.,** Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.N., 958, Gravesend.] *Manager*, J. R. Groves; *Sec.*, H. C. Walter; *Chairman*, W. L. Madgen; *Directors*, P. N. Gray, W. S. Wreathall.

**Great Crosby Tramways,** 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

**Great Grimsby Street Tramway Co.,** Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

**Greenock and Port Glasgow Tramways Company,** Ladyburn, Greenock, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

**Guernsey Railway Company, Ltd.,** Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valied, J. B. Collings, Q. Le Pelley.

**Hampshire Light Railway (Electric) Company, Ltd.,** Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

**Hastings Tramways Company, Ltd.,** Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Chairman*, G. Kitchen; *Directors*, E. C. Morgan, J. C. Williamson, Dr. Moody.

**Imperial Tramways Company, Ltd.,** Clare Street House, Bristol. *Secretary*, F. H. Withers; *Manager*, F. Freshwater; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), H. C. Godfray, J. H. Howell, Sir G. Stanley White, Bart.

**Isle of Thanet Electric Tramways and Lighting Company, Ltd.,** St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ——; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

**Jarrow and District Electric Traction Company, Ltd.,** Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.* H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

**Kidderminster & District Electric Lighting and Traction Co., Ltd.,** Kidderminster and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.N., 108]. *General Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

**Kinver Tramway,** Kinver, and Electrical Federation Offices, Manchester Hotel, London, E.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

**Lanarkshire Tramways Company,** Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

**Lancashire United Tramways Limited,** Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., R. Watson, J.P., A. Adam, J. S. Austen.

**Liverpool and Prescot Light Railway.**—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

**Liverpool Overhead Railway Company,** 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey, J. U. Hodgson, M. H. Maxwell.

**Llandudno and Colwyn Bay Electric Railway, Limited,** Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

**Llanelly and District Electric Lighting and Traction Company, Ltd.,** Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, G. D. Prince; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

**London United Tramways Ltd.,** Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager and Eng.*, A. H. Pott; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, F. V. Schuster, W. C. Burton, H. A. Vernet.

**Luton Corporation Tramways** (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

**Mansfield & District Light Railway Co.,** Sutton Road, Mansfield. [T.A., Cars. Mansfield, T.N., 107.] *Gen. Manager and Sec.*, Stanley Dudman, *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn A. H. Beatty, G. Balfour.

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# ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

**Manx Electric Railway Company, Ltd.**, 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Huni; *Chairman*, Col. Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Remnant.

**Merthyr Electric Traction and Lighting Company, Ltd.**, 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, S. J. Clements; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

**Metropolitan Electric Tramways, Limited**, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager and Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barber; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

**Mexborough and Swinton Tramways Company**, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, G. H. Browne; *Cons. Elec. Eng.*, F. E. Stanley; *Commercial Manager*, Wm. T. Mitchell; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Director (Managing)*, W. B. Cownie, C.A.

**Middlesbro, Stockton, and Thornaby Electric Tramway**, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Secretary*, F. H. Withers; *Chairman*, Samuel White, J.P.; *Directors*, H. C. Godfray, James H. Howell, J.P., Sir G. Stanley White, Bart., W. G. Verdon Smith (*Managing Director*).

**Middleton Electric Traction Company, Ltd.**, Hiltonfold Lane, Middleton, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, G. R. Oliphant; *Acting Secretary*, J. S. Bowker; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

**Morecambe Tramways Company**, Heysham Road, Morecambe, and 62, Market Street, Lancaster. [T.N. 1, Morecambe, and 71, Lancaster.] *Secretary and Manager*, G. H. Petty; *Chairman*, W. H. Pickles; *Directors*, J. Stott, S. Wright, O. Carr.

**Musselburgh and District Electric Light and Traction Co., Ltd.**, High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager*, E. J. Walsh; *Resident Engineer*, E. J. Walsh; *Traffic Inspector*, W. Mittell; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, B. Burnham, J. Anderson, W. B. Cownie, R. Watson.

**New General Traction Company, Ltd.**, 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger. [This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

**New St. Helens and District Tramways Company, Ltd.**, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 86 Atherton.] *Engineer and Manager*, C. D. Stanley; *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

**North Shields Tramway Company** owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

**Norwich Electric Tramway Company**, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Directors*, E. A. Hopkins, F. FitzGerald, G. M. Chamberlin, C. Pakeman, and R. J. West.

**Nottinghamshire and Derbyshire Tramways Company**, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, C. R. Walker; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, A. V. Anderson, and M. A. Edwards.

**Oldham, Ashton and Hyde Electric Tramway, Ltd.**, Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Denton: T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, F. J. Cursons; *Acting Secretary*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, Judge L. A. Atherley Jones, K.C., W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

**Paisley District Tramways Company**, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

**Peterborough Electric Traction Company, Ltd.**, Lincoln Road, Peterborough, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, T. G. Clabburn; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, Lord Vaux of Harrowden; *Directors*, E. A. Paris, R. J. Howley.

**Plymouth, Stonehouse and Devonport Tramways Co.**, 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

**Portsdown and Horndean Light Railway**, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

**Potteries Electric Traction Company**, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Stoke-on-Trent; T.N., 141.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, B. Kingsford; *Chairman*, R. J. Howley; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

**Rhondda Tramways Company, Ltd.**, Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramways, Porth; T.N., 118.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

**Rothesay Tramways Company, Ltd.**, Point House, Rothesay, and Electrical Federation Offices, Manchester Hotel, London, E.C. *Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, H. S. Day.

**Ryde Pier Company**, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

**Scarborough Tramways Company**, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, J. C. Wigham.

**Sheerness and District Electric Power and Traction Company, Ltd.**, Electricity Works, Sheerness East, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Sheerness; T.N., 45.] *Manager & Eng.*, A. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, R. J. Howley, E. R. Soames.

**Snaefell Mountain Railway** (See Manx Electric Railway Company).

**South Metropolitan Electric Tramways and Lighting Company, Ltd.**, 114, Church Street, Croydon, 30, High Street, Sutton, and Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 304 Croydon, 14 Sutton and 6800, Victoria.] *Gen. Manager and Engineer*, A. V. Mason; *Secretary*, W. M. Wright; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire (*managing*), E. Garcke, A. L. Barber.

**Southport Pier Co., Ltd.**, Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, A. T. Faiers; *Chairman*, A. Skinner; *Directors*, J. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

**Southport Tramways Company, Ltd.**, The Depôt, Churchtown, Southport, and Electrical Federation Offices, Manchester Hotel, London, E.C. *Manager*, J. Lloyd; *Secretary*, H. A. Stagg; *Chairman*, C. S. Hilton; *Directors*, J. S. Raworth, Lord Vaux of Harrowden, J. V. Kitchener, G. R. Hulme.

**South Staffordshire Tramways (Lessee) Company, Ltd.**, Electrical Federation Offices, Manchester Hotel, London, E.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, S. R. Blundstone, R. J. Howley, B. Kingsford.

**Sunderland District Electric Tramways. Ltd.**, Fence Houses, co. Durham. [T.A., Trams, Philadelphia, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler, A. Counter, C. Eves.

**Sutton and Howth Electric Tramway Company** (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Station, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Chief Eng.* F. A. Campion; *Locomotive Eng.*, G. T. Glover; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), W. B. Carson, H. S. Guinness, J. T. Reade, Capt. W. L. A. Goulding, Lt.-Col. J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews, G. S. Clark.

**Swansea Improvements and Tramways Company**, 2, Rutland St., Swansea, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramway, Swansea; T.N., 268 Swansea.] *Gen. Manager*, D. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke, E. R. Soames.

**Taunton Electric Traction Company, Ltd.**, East Reach, Taunton, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Taunton, c/o "Tramways," London.] *Manager*, B. H. Griffith; *Acting Manager*, L. Marshall; *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Director*, E. Garcke.

**Torquay Tramways Co., Ltd.**, St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. J. Nisbett; *Secretary*, L. D. H. Jacobs; *Managing Director*, W. B. Cownie.

**Trafford Park Company (Tramways)**, Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Marshall Stevens; *Directors*, Sir J. Lyons, H. McNiel, J. H. Balfour Browne, K.C.

[Lines worked by the Manchester and Salford Corporations.]

**Tynemouth and District Electric Traction Company, Limited**, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, H. J. Smith; *Sec.*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, R. J. Howley, Geo. J. Somerville.

**Tyneside Tramways and Tramroad Company, Ltd.**, Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

**Walton-on-the-Naze Pier Tramway** (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Eng.*, E. A. Lambert, A.M.I.E.E.

**Wemyss and District Tramways Company, Ltd.**, Car Depot, Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 88 Leven.] *Gen. Manager*, W. T. Dawson; *Sec.*, J. O. Shepherd; *Chairman*, G. Balfour; *Directors*, W. Shepherd, G. Balfour, J. H. Guild.

**Weston-super-Mare and District Electric Supply Co., Ltd.**, Locking Road, Weston-super-Mare, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, E. R. Soames.

**Wolverhampton District Electric Tramways, Limited**, Tramway Depot, Bilston, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Bilston; T.N., 56, Bilston.] *General Manager*, W. G. Bond; *Sec.*, E. H Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford.

**Worcester Electric Traction Company Ltd.**, St. John's, Worcester, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Worcester; T.N., 81.] *Engineering Manager* R. Simpson; *Secretary*, C. W. Francis; *Acting Sec.*, H. A. Stagg; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, B. Kingsford, W. S. Wreathall.

**Wrexham and District Transport Co., Ltd.**, 6, Lord Street, Wrexham, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Wrexham; T.N., 182, Wrexham.] *Manager*, A. A. Hawkins; *Sec.*, J. R. Oliphant; *Acting Sec.*, J. S. Bowker; *Chairman*, J. V. Kitchener; *Directors*, G. J. Somerville, W. S. Wreathail.

**Yorkshire (West Riding) Electric Tramways Co., Ltd.**, Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England: *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. J. McDonald; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, B. Newgass, G. E. Leon, E. Remnant, W. Murray.

**Yorkshire (Woollen District) Electric Tramways, Limited**, Frost Hill, Liversedge, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

# TRAMWAY ASSOCIATIONS.

## MUNICIPAL TRAMWAYS ASSOCIATION

*President:*
Alderman S. Flint.
(Chairman, Leicester Tramways Committee).

*Vice-President:*
Mr. T. B. Goodyer.
(General Manager, Croydon Corporation Tramways).

*Chairman:*
J. B. Hamilton
(General Manager, Leeds Corporation Tramways).

*Hon. Treasurer:*
C. J. Spencer
(General Manager, Bradford Corporation Tramways).

*Hon. Secretary:*
A. R. Fearnley
(General Manager, Sheffield Corporation Tramways).

Offices: Division Street, Sheffield.
Telegrams: "Tramways," Sheffield.
Telephone No. 4600 City.

## TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

*President:*
The Rt. Hon. Viscount Chilston.

*Chairman:*
The Hon. Arthur Stanley, M.P.

*Vice-Chairman:*
Harry England.

*Hon. Solicitor:* W. Morris, Junr.
*Hon. Auditor:* A. W. Chambers, A.S.A.A.

*Secretary:*
A. de Turckheim.

*Offices:* Sanctuary Chambers, Tothill Street, Westminster, London, S.W.
Telephone No. 2110 Victoria.

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# LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

## PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxvii-xxx. RAILWAYS, p. xxx.

| Location of Line and Name of Operating Company. | Date of Opening of First Section. | Length of Route. | Total length of Track. | Gauge. | | Weight and Type of Rail. | Maximum Gradient. | Sharpest Curve. | No of Motor Cars. | No of Dynamos | No. of Engines | Type of Engines | Total Capacity Traction, kw. | Principal Contractors for Electrical Equipment. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TRAMWAYS.** | | | | ft. | in. | lbs. | 1 in | ft. rad. | | | | | | |
| Aberdare Urban District Trys. .. | Oct., 1913 | 2·9 | 3·3 | 3 | 6 | 96 G | 13 | 45 | 14 | 2 | 2 | V. Cp. C. | 400 | Lanc. Dynamo Co. |
| Aberdeen Corporation .. .. | Dec., 1899 | 14·4 | 27·75 | 4 | 8½ | 96 G | 13 | 42·5 | 83 | *14 | 14 | V. Cp. C. | 4,610 | British T-H.<br>Macartney & Co. |
| Aberdeen Suburban Trys. Co. .. | June, 1905 | 5 | 5 | 4 | 8½ | 95 G | 28 | 90 | 9 | .. | .. | .. | .. | J. G. White & Co.<br>Brush Co. |
| Accrington Corporation .. .. | Aug., 1907 | 7·53 | 10·53 | 4 | 0 | 95 G | 14 | .. | 32 | *8 | 8 | .. | 1,888 | Brush Co. |
| Airdrie & Coatbridge Tramway Co. | Feb., 1904 | 3·63 | 4·94 | 4 | 8½ | 94 G | 14 | 210 | 15 | .. | .. | .. | .. | Brush Co. |
| Ashton-under-Lyne Corporation .. | Aug., 1902 | 7 | 8·15 | 4 | 7¾ | 96 G | 10 | 40 | 25 | 5 | 5 | .. | 400 | Dick, Kerr, & Co.<br>Siemens Bros. |
| Ayr Corporation .. .. .. | Sept., 1901 | 6 | 7·612 | 4 | 8½ | 90 G | 21 | 45 | 24 | *8 | 8 | .. | 400 | British T-H. |
| Bacup Corporation .. .. .. | 1910 | 1·50 | 2 | 4 | 8½ | 103 G | 9 | 40 | .. | .. | .. | .. | .. | |
| Barking Town Urban District .. | Dec., 1903 | 2·6 | 3·125 | 4 | 8½ | 100 G | 25 | 44 | 9 | 4 | 3 | V. Cp. C. | 200 | Blackwell & Co. |
| Barnsley & Dist. Elec. Traction Co. | Nov., 1902 | 3·06 | 4·25 | 4 | 8½ | 97 G | 10 | 60 | 13 | * | .. | .. | .. | J. G. White & Co.<br>Brush Co. |
| Barrow-in-Furness .. .. .. | Feb., 1904 | 6·9 | 10·32 | 4 | 0 | 90 G | 13 | 50 | 24 | *8 | .. | .. | .. | Brush Co.<br>Dick, Kerr, & Co. |
| Bath Electric Tramways, Ltd. .. | Jan., 1904 | 14·7 | 19·3 | 4 | 8½ | 95 G | 10·7 | 38 | 40 | 4 | 4 | H.T. Cp. | 675 | Westinghouse |
| Batley Corporation .. .. .. | Aug., 1903 | 6·536 | 10·47 | 4 | 8½ | 104 G | 9 | 40 | 15 | 6 | 4 | H. Cp. | 240 | B. I. W. Co.<br>British Elc. Cr. Co |
| Belfast City .. .. .. .. | Dec., 1905 | 49·65 | 98·54 | 4 | 8½ | 105 G | 15 | 35 | 291 | 3 | 3 | Tri. Exp. | 3,000 | J. G. White & Co.<br>Westinghouse |
| Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co. | Oct., 1885 | 3 | 3 | 3 | 0 | 41 V | 80 | 55 | 2 M<br>2 T | 2 | 1 | Hyd. Turb. | .. | Mather & Platt |
| Bexley Urban District .. .. | Oct., 1903 | 12·81 | 16·21 | 4 | 8½ | 90 G | 9 | 40 | 39 | 3 | 3 | V. Cp. | 600 | Dick, Kerr, & Co. |
| Birkenhead Corporation .. .. | Feb., 1901 | 13·8 | 24·09 | 4 | 8½ | 100 G | 13½ | 40 | 65 | 6 | 6 | V. Cp. | .. | Blackwell & Co.<br>British T-H. |
| Birmingham Corporation .. .. | Jan., 1904 | 65·56 | 123 | 3 | 6 | 105 G | 13 | 40 | 586 | .. | .. | .. | 1,475 | Dick, Kerr, & Co. |
| Birmingham and Midland Trys. Co. | Nov, 1904 | 10·32 | 16·45 | 3 | 6 | 85 & 94 G | 15 | 31 | 62 | 6 | 6 | Cp. | .. | Brush Co. |
| Blackburn Corporation .. .. | March, 1899 | 14·67 | 24·75 | 4 | 0 | 92 G | 15 | 30 | 61 | *4 | 4 | V. Cp. C. | .. | British T-H.<br>Blackwell & Co. |
| Blackpool Corporation .. .. | Oct., 1885 | 14·75 | 21·38 | 4 | 8½ | 96 G | 20 | 36 | 84 | 5 | .. | Turb. | 3,250 | Elwell-Parker<br>British T-H. |
| Blackpool & Fleetwood Tramrd. Co. | July, 1898 | 7·9 | 15 | 4 | 8½ | 70 V<br>98 G | 26 | 80 | 41 | 5 | 5 | V. Cp. | 600 | Mather & Platt<br>D.K.&Co.-B.T-H. |
| Blackpool and Fylde Light Ry. Co. | Under cons. | 14 | 14·5 | 4 | 8½ | .. | .. | .. | .. | .. | .. | .. | .. | |
| Blackpool—St. Anne's & Lytham .. | May, 1903 | 7·47 | 14·03 | 4 | 8½ | 92 G | 22 | 35 | 40 | .. | .. | .. | .. | British T-H. |
| Bolton Corporation .. .. .. | Nov., 1899 | 26 | 47·8 | 4 | 8½ | 90G | 14 | 35 | 112 | *12 | 12 | V. Cp. C. | 3,800 | Dick, Kerr, & Co.<br>Blackwell & Co. |
| Bootle Corporation .. .. .. | May, 1900 | 4·125 | 7·75 | 4 | 8½ | 95 G | 20 | 40 | 55 | *8 | 8 | .. | 4,000 | Blackwell & Co. |
| Bournemouth Corporation .. .. | July, 1902 | 21·66 | 32·75 | 3 | 6 | 100 G<br>66 slot | 10 | 40 | 91 | 5 | 4 | V. Cp. | 1,200 | J. G. White & Co. |
| Bradford Corporation .. .. | July, 1898 | 59 | 108·75 | 4 | 0 | 102 G | 9·8 | 40 | ‡272 | 11 | 11 | V. Cp. C. | .. | Westinghouse<br>Blackwell & Co. |
| Bray and Enniskerry Railway Co. | Under cons. | 3·25 | 5 | 3 | 6 | .. | .. | .. | .. | .. | .. | .. | .. | Macartney & Co. |
| Brighton Corporation .. .. | Nov., 1901 | 9·48 | 17·19 | 3 | 6 | 105 B.S. No. 4 | 9 | 40 | 53 | 5 | 5 | Turb. | 1,000 | Westinghouse<br>Blackwell & Co. |
| Brighton Beach (1) .. .. .. | Aug., 1883 | 1·75 | 2 | 2 | 8½ | 35 V | 100 | 80 | 9 | 2 | .. | .. | .. | Siemens Bros. |
| Bristol—Bristol Trys. Co. .. .. | Oct., 1895 | 31 | 57·5 | 4 | 8½ | 92½ G | 10 | 30 | 232 | 6 | 4 | V. Cp. C. | .. | British T-H. and<br>Blackwell & Co. |
| Burnley Corporation .. .. | Dec., 1901 | 12·50 | 22·16 | 4 | 0 | 102 & 107 G | 9·8 | 35 | 67 | *8 | 6 | H. Cp. C. | 1,500 | British T-H. |
| Burton and Ashby Light Railway.. | July, 1906 | 10·2 | 12·3 | 3 | 6 | 90 G | 11 | 51 | 20 | 2 | 2 | Diesel | 330 | Dick, Kerr & Co.<br>Brush Co. |
| Burton-on-Trent Corporation .. | Aug., 1903 | 6·67 | 9·75 | 3 | 6 | 90 & 100 G | 11·7 | 40 | 20 | 3 | 3 | V. Cp. | 400 | Dick, Kerr, & Co.<br>Blackwell & Co. |
| Bury Corporation .. .. .. | June, 1903 | 22·5 | 37·75 | 4 | 8½ | 102¾ G | 12 | 40 | 54 | 6 | 6 | .. | 1,500 | Westinghouse |
| Camborne and Redruth .. .. | Nov., 1902 | 3·75 | 4 | 3 | 6 | 83 G | 15 | 40 | 8 | 7 | 7 | Cp. | 1,525 | Dick, Kerr, & Co.<br>British T-H. |
| Cardiff Corporation .. .. .. | May, 1902 | 17·25 | 31·82 | 4 | 8½ | 100 G | 23 | 35 | 130 | 9 | 9 | V. Cp. C & T | 2,200 | British T-H.<br>Dick, Kerr, & Co. |
| Carlisle, City of, Elec. Try. Co. .. | June, 1900 | 7·25 | 8·5 | 3 | 6 | 83 G | 14 | 23 | 12 | .. | .. | .. | .. | D.K.& Co.-B.T-H. |
| Cavehill & Whitewell Try. Co... | Feb., 1906 | 3·29 | 4·31 | 4 | 9 | 105 G | 31 | 75 | 10 | .. | .. | .. | .. | J. G. White & Co. |
| Chatham & District Light Rly. Co. | June, 1902 | 14·98 | 26 | 3 | 6 | 92½ & 105 G | 9 | 35 | 50 | 5 | 4 | H. Cp. | 675 | British T-H. Co.<br>Brush Co. |
| Cheltenham and District .. | Aug., 1901 | 10·22 | 12·25 | 3 | 6 | 80 & 90 G | 8·9 | 37 | 20 | 2 | 2 | V. Cp. | .. | Westinghouse |
| Chester Corporation.. .. .. | April, 1903 | 3·59 | 6·4 | 3 | 6 | 94 & 100 G | 23 | 40 | 18 | *7 | 6<br>1 | V. Cp. C.<br>V. Tri. Ex C | 240 | Blackwell & Co.<br>British T-H. |
| Chesterfield Corporation .. .. | Dec., 1904 | 3·6 | 5·1 | 4 | 8½ | 96 &<br>101 G | 20 | 40 | 17 | 4 | 4 | V. Cp. C. | 800 | Milnes & Co.<br>Westinghouse<br>Brush |
| Clontarf and Hill of Howth .. | July, 1900 | 5·5 | 6·5 | 5 | 3 | 90 & 60 G | 13 | 34 | 12 | .. | .. | .. | .. | W. M. Murphy & Co. |
| Colchester Corporation .. .. | July, 1904 | 6 | 7·94 | 3 | 6 | 95 G | 12 | 43 | 18 | 8 | 8 | V. Cp. | 1,140 | Dick, Kerr & Co.<br>J. G. White & Co. |
| Colne Corporation Tramways .. | Nov., 1903 | 5·2 | 6·7 | 4 | 0 | 102 G | 13 | 60 | 13 | * | .. | .. | .. | Blackwell & B.T-H.<br>Glover & Co. |
| Cork Elec. Try. & Lighting Co. .. | Dec., 1898 | 10 | 15 | 2 | 11½ | 83 G | 14 | 26 | 35 | *9 | 9 | H. Cp. C. | 570 | British T-H.<br>Blackwell & Co. |
| Coventry Corporation Tramways.. | Dec., 1895 | 12·88 | 15·81 | 3 | 6 | 65 G<br>81 G | 16 | 35 | 51 | 5 | 3 | H. & V. Cp. | 1,500 | Westinghouse<br>Blackwell & Co. |
| Croydon Corporation .. .. .. | Sept., 1901 | 11·87 | 19·12 | 4 | 8½ | 96·5 G | 16 | 40 | 75 | *13 | 13 | .. | 2,000 | British T-H. Co. |
| Darlington Corporation .. .. | June, 1904 | 4·875 | 8·88 | 3 | 6 | 90 G | 14 | 52·8 | 18 | 1 | .. | .. | 250 | Westinghouse |

* Current from combined lighting and traction station. (1) Third rail system. † Includes 1·25 miles railless trolley line. ‡ Includes 20 railess cars.
M—Motor Cars. T—Trail Cars.

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## ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

| Location of Line and Name of Operating Company. | Date of Opening of First Section. | Length of Route. | Total Length of Track. | Gauge. | Weight and Type of Rail. | Maximum Gradient. | Sharpest Curve. | No. of Motor Cars | No. of Dynamos | No. of Engines | Type of Engines. | Total Capacity Traction, kw. | Principal Contractors for Electrical Equipment. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TRAMWAYS**—*continued.* | | | | ft. in. | lbs. | 1 in | ft. rad. | | | | | | |
| Dartford U. D. C. | Feb., 1906 | 6·5 | 8·5 | 4 8½ | 100 G | 12 | 35 | 12 | 4 | .. | .. | .. | British I. W. |
| Darwen Corporation | Oct., 1900 | 4·36 | 7·16 | 4 0 | 95 G | 9 | 35 | 19 | *4 | 4 | H. Cp. | .. | British T-H. |
| Derby and Ashbourne | .. | 14·5 | .. | 4 8½ | | | | | | | | | |
| Derby Corporation | July, 1904 | 13 | 22·25 | 4 0 | 95 G | 14 | 46 | 50 | 3 | 3 | Turb. | .. | J. G. White & Co. Brush & B.T-H. |
| Devonport Corporation | June, 1901 | .. | 7 | 3 6 | 97 G | 10 | 50 | 12 | .. | .. | .. | .. | Blackwell & Co. |
| Doncaster Corporation | June, 1902 | 8·25 | 12·52 | 4 8½ | 94 G | 16 | 45 | 32 | 8 | 8 | .. | 1,000 | Blackwell & Co. |
| Dover Corporation | Sept., 1897 | 4·75 | 7 | 3 6 | 87 & 90 G | 10 | 44 | 24 | *2 | 2 | H.CC. | .. | D K. & B. T-H |
| Douglas—Port Soderick; Douglas Southern Elec. Trys. Co. | Aug., 1896 | 3·25 | 3·75 | 4 8½ | 65 V | 12 | 45 | 8 M, 8 T | 2 | 2 | H. Cp. | 200 | Westinghouse, British T-H. |
| Dublin & Lucan Elec. Railway Co. | March, 1900 | 6·5 | 7 | 3 6 | 50 V | 20 | 27 | 9 M, 5 T | 2 | 2 | H.Cp.C. | 240 | Dick, Kerr, & Co. |
| Dublin United Tramways Co. | May, 1896 | 49·8 | 100·75 | 5 3 | 105 G | 12·3 | 22 | 365 | 8 | 8 | Cp.&Tur | 5,500 | Dick, Kerr, & Co. Blackwell & Co. British T-H. |
| Dudley and Stourbridge Trys. British Electric Traction Co. | July, 1899 | 22·88 | 30·97 | 3 6 | 90 G | 11 | 50 | 59 | 4 | 4 | H. Cp. | .. | British T-H. Blackwell & Co. |
| Dumbarton | Feb., 1907 | 13 | 17 | 4 7¾ | 90 & 96 | 14 | 60 | 30 | 3 | 3 | .. | .. | Dick, Kerr, & Co. |
| Dundalk | Under cons. | 6 | 6·25 | 3 6 | 97 G | 10 | 50 | 12 | | | | | White & B.T-H. |
| Dundee, Broughty Ferry, and District | Dec., 1905 | 4·125 | 7·25 | 4 8½ | 90 G | 16·5 | 30½ | 14 | 3 | 3 | V.Cp.C. | .. | J. G. White & Co. British T-H. Co. |
| Dundee Corporation | July, 1900 | 16·3 | 30·12 | 4 8½ | 90 & 100 G | 10 | 35 | 76 | 5 | 5 | .. | .. | Blackwell & Co. |
| Dunfermline (Fife Try. & Power Co.) | Nov., 1909 | 14·6 | 17·4 | .. | 90 G | 10 | 25 | 28 | .. | .. | .. | .. | British T-H. |
| East Ham Corporation | June, 1901 | 7·58 | 14·20 | 4 8½ | 90 & 105 G | 25 | 40 | 45 | *5 | 5 | H. Cp. | 750 | Dick, Kerr, & Co. |
| Eccles Corporation | May, 1902 | 5 | 7·75 | 4 8½ | 100 G | .. | .. | .. | .. | .. | .. | .. | |
| Edinburgh and District | June, 1910 | 1·25 | 1·5 | 4 8½ | 100 G | 21 | 54 | 4 | .. | .. | .. | .. | Dick, Kerr, & Co. |
| Erith Urban District Council | Aug., 1905 | 4·7 | 8·4 | 4 8½ | 100 G | 17 | 40 | 17 | 3 | 5 | .. | .. | Brush Co. Westinghouse Co. |
| Exeter Corporation | April, 1905 | 4·875 | 7 | 3 6 | 90 G | 11·5 | 35 | 24 | *4 | 4 | H. Cp. | .. | Dick, Kerr, & Co. |
| Falkirk and District | Oct. 1905 | 7·81 | 10·5 | 4 0 | 90 G. | 11·3 | 48 | 18 | * | .. | .. | .. | Bruce-Peebles British T-H. |
| Farnworth Urban District | Jan., 1902 | 4·33 | 7·16 | 4 8½ | 98 G | 29 | 36 | .. | .. | .. | .. | .. | |
| Felixstowe Pier | Aug., 1905 | 0·5 | 0·5 | 3 6 | 36 | .. | .. | 3 | .. | .. | .. | .. | |
| Gateshead and District | May, 1901 | 12·38 | 20·02 | 4 8½ | 90 G | 8 | 35 | 55 | * | .. | .. | .. | Dick, Kerr, & Co. Blackwell & Co. |
| Giant's Causeway Elec. Try. Co. | Sept., 1883 | 8 | 9 | 3 0 | 42 V, 75 G | 24 | 30 | 5 M, 21 T | 2 | 2 | Hyd.Turb. | .. | Siemens Bros. British T-H. |
| Glasgow Corporation | Oct., 1898 | 99·26 | 198·25 | 4 7¾ | 110 G | 11·93 | 30¾ | 857 | 8 | 8 | V.Cp.&T | 21,700 | British T-H. Westinghouse |
| Glossop Urban District | Aug., 1903 | 4·56 | 5·6 | 4 8½ | 90 G | 13 | 40 | 8 | 4 | 4 | V. Cp. | 200 | British T-H. |
| Gloucester Corporation Light Rly. | May, 1904 | 9 | 15 | 3 6 | 90 G | 25 | 40 | 30 | *2 | 2 | Cp. | 750 | Brush Co. Dick, Kerr, & Co. |
| Gosport & Fareham Trys. Co. | Jan., 1906 | 7·5 | 11·5 | 4 7¾ | 96 G | 16 | 37½ | 22 | 3 | 3 | V.Cp.C. | 750 | Dick, Kerr, & Co. Brush Co. |
| Gravesend and Northfleet | Aug., 1902 | 6·5 | 9 | 4 8½ | 87 G | 11 | 45 | 18 | * | | | | |
| Great Crosby | June, 1900 | 2·5 | 2·5 | 4 8½ | 92½ G | .. | 40 | 14 | *7 | 7 | H.&V.Cp. | 160 | Dick, Kerr, & Co. Blackwell & Co. |
| Great Grimsby | Dec., 1901 | 6 | 11 | 4 8½ | 90 G | 15 | 26 | 32 M, 6 T | 3 | 3 | .. | 400 | Dick, Kerr, & Co. |
| Greenock and Port Glasgow | Oct., 1901 | 7·425 | 14·05 | 4 7¾ | 90 G | 11 | 60 | 42 | * | .. | .. | .. | |
| Guernsey Railway Co. | Nov., 1892 | 3 | 3 | 4 8½ | 74 V, 84 G | 60 | 60 | 9 M, 8 T | 2 | 1 | H.&V.Cp. | 160 | Siemens Bros. British T-H. |
| Halifax Corporation | June, 1898 | 37·53 | 55·5 | 3 6 | 95½ G | 9·5 | 38·6 | 101 | *7 | 7 | H.&V.Cp. & T. | 3,000 | Electric Cons. Co. British T-H. |
| Hampshire Light Railway (Elec.) Co. | March, 1903 | 6 | 9 | 4 8½ | .. | .. | .. | 10 | * | .. | .. | .. | |
| Haslingden Corporation | July, 1908 | 3 | 3 | 4 0 | 100 G | 10 | 30 | .. | .. | .. | .. | 45 | Dick, Kerr, & Co. |
| Hastings and District | July, 1905 | 19·33 | 33·25 | 3 6 | 90 G | 8 | 30 | 65 | 6 | 6 | V. Cp. | 2,100 | Dick, Kerr, & Co. |
| Herne Bay Pier (1) | March, 1899 | ·75 | ·75 | 3 0 | 60 | .. | .. | 3 | 1 | 1 | Gas | 50 | British T-H. |
| Heywood Corporation | Dec., 1905 | 4·25 | 4·25 | 4 8½ | 90 G | 17 | .. | .. | 1 | 1 | .. | 300 | Blackwell & Co. B.I. & H.C. Co. |
| Houghton-le-Spring (See Sunderland Dist. Elec. Trys.) | | | | | | | | | | | | | |
| Huddersfield Corporation | Feb., 1901 | 34·50 | 56 | 4 7¾ | 98 G | 11 | 35 | 106 | 4 | 4 | V.Cp.C. | 2,200 | British T-H. |
| Hull Corporation | July, 1899 | 13·46 | 29·5 | 4 8½ | 94 G | 20 | 30 | 180 | 7 | 7 | V.Cp.C. | 2,560 | British T-H. Westinghouse |
| Ilford Urban District | Mar., 1903 | 7·42 | 12·62 | 4 8½ | 95 G | 13 | 33·3 | 28 | *7 | 7 | .. | 1,600 | British T-H. Dick, Kerr, & Co. |
| Ilkeston Tramways | May, 1903 | 3·8 | 4·3 | 3 6 | 90 G | 12 | 28 | 13 | .. | .. | .. | .. | Dick, Kerr, & Co. |
| Ipswich Corporation | Nov., 1903 | 10·8 | 14·87 | 3 6 | 90 G | 11·5 | 40 | 36 | *10 | 10 | Enclos'd | 1,175 | Westinghouse |
| Isle of Man— | | | | | | | | | | | | | |
| Manx Elc. Rly. Co.: Douglas to Ramsey | July, 1893 | 18 | 35·75 | 3 0 | 62½ V | 24 | 90 | 34 M, 29 T | 8 | 9 | H. Cp. | 1,300 | Mather & Platt |
| Manx Elc. Rly. Co.: Snaefell Mountain | Aug., 1895 | 4·5 | 9·5 | 3 6 | 56 V | 12 | 90 | 6 | 5 | 4 | H. Cp. | 390 | |
| Isle of Thanet Trys. & Ltg. Co. | April, 1901 | 11 | 20·67 | 3 6 | 90 & 100 G | 11 | 38 | 59 | *6 | 6 | 3 V. Cp., 3 H. Cp. | 800 | British T-H. Blackwell & Co. |
| Jarrow and District | Nov., 1906 | 2·54 | 3·42 | 4 8½ | 95 G | 12·5 | 50 | 10 | .. | .. | .. | .. | Brush Co. B.I. & H.C. Co. |
| Kearsley Urban District | Jan., 1902 | 1·75 | 1·75 | 4 8½ | 95 G | 20 | .. | .. | .. | .. | .. | .. | Westinghouse |
| Keighley Corporation | Oct., 1904 | 3·5 | 6·11 | 4 0 | 95 G | 25 | 60 | 12 | *4 | 4 | V. | 200 | Blackwell & Co. Brush & B.T-H. |
| Kidderminster—Stourport British Electric Traction Co. | May, 1898 | 4·6 | 4·87 | 3 6 | 75 G | 14 | 45 | 13 | *5 | 5 | Stm Turb. | .. | Brush Elc.Eg.Co. |
| Kilmarnock Corporation | Dec., 1904 | 4·18 | 5·5 | 4 8½ | 90 G | 24 | 45 | 14 | *3 | 3 | .. | 250 | Blackwell & Co. |
| King's Norton & Northfield U. D. | May, 1904 | 5·25 | 8·25 | 3 6 | 105 G | 15&21 | 100&145 | .. | .. | .. | .. | .. | Blackwell & Co. |
| Kinver | April, 1901 | 4·25 | 6 | 3 6 | 63 & 90 G | .. | .. | 6 | | | | | |
| Kirkcaldy Corporation | Feb., 1903 | 6·11 | 8·56 | 3 6 | 100 G | 11 | 40 | 26 | *10 | 6 | Cp.H.T. | 2,290 | British T-H. Co. |
| Lanarkshire Tramway Co. | July, 1903 | 28·431 | 43·120 | 4 7¾ | 96 & 101 G | 9·4 | 37 | 76 | 4 | 4 | 3 H. Cp., 1 V. Cp. | 825 | British T-H. Co. |
| Lancashire United Tramways Co. | Oct., 1902 | 39 | 42 | 4 8½ | 90 G | 15 | 50 | 82 | *8 | 8 | V.Cp.C&T | 7,000 | B. I. W. Co. |
| Lancaster Corporation | Jan., 1903 | 4 | 4·81 | 4 8½ | 90 G | 8 | 30 | 12 | 4 | 4 | V. Cp. | 200 | Greenwood & Batley, Ltd. |
| Leamington & Warwick Elec. T. Co. | July, 1905 | 3·04 | 6·1 | 3 6 | 65 G | 12 | 47 | 12 | 3 | 3 | Cp. | .. | Brush Co. |
| Leeds City | Aug., 1897 | 65·97 | 120·81 | 4 8½ | 105 & 111 G | 8·4 | 32 | 345 | 5, 3 | 5, 3 | H. Cp.C., Stm.Tur | 6,150 | Elec. Con. Co. Greenwood & Batley, British T-H. Blackwell & Co. |

* Current from combined lighting and traction station. (1) Third Rail system. M—Motor Cars. T—Trail Cars.

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## ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

| Location of Line and Name of Operating Company. | Date of Opening of First Section. | Length of Route. | Total length of Track. | Gauge. | | Weight and Type of Rail. | Maximum Gradient. | Sharpest Curve. | No. of Motor Cars. | No. of Dynamos | No. of Engines | Type of Engines. | Total Capacity Traction, kw. | Principal Contractors for Electrical Equipment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ft. | in. | lbs. | 1 in | ft. rad. | | | | | | |
| **TRAMWAYS**—*continued.* | | | | | | | | | | | | | | |
| LEICESTER Corporation .. .. | May, 1904 | 20·25 | 38 | 4 | 8½ | 100 G | 16 | 35 | 160 | 7 | 7 | V.Cp.C&T | 9,250 | Dick, Kerr, & Co. / Blackwell & Co. |
| LEITH Corporation .. .. .. | Aug., 1905 | 9·08 | 17·9 | 4 | 8½ | 106·7 G | 19 | 54 | 37 | *11 | 11 | .. | 1,600 | Brush & B.T-H. |
| LEYTON URBAN DISTRICT .. .. | Dec., 1906 | 8·95 | 17·694 | 4 | 8½ | 105 & 111 G | 24 | 45 | 60 | *4 | 4 | Cp.T.E&T | 2,040 | .. |
| LINCOLN Corporation (1) .. .. | Nov., 1905 | 1·75 | 2·96 | 4 | 8½ | 100 G | .. | 36 | 8 | *9 | 9 | .. | 120 | |
| LIVERPOOL Corporation .. .. | Nov., 1898 | 70 | 124 | 4 | 8½ | 95, 123 & 134 G | 13 | 30 | 599 | *42 | 42 | Trip.Ex. | 44,600 | Blackwell & Co. / British T-H. / Dick, Kerr, & Co. / Westinghouse |
| LIVERPOOL Overh'd Ry. (Trol.Ln.Ex.) | June, 1900 | 2·5 | 2·5 | 4 | 8½ | 92½ G | Nil | 40 | 14 | 7 | 7 | H.&V.Cp. | 160 | Dick, Kerr, & Co. |
| LLANDUDNO AND COLWYN BAY .. | Oct., 1907 | 8·37 | 13·60 | 3 | 6 | 90 G | 11·5 | 45 | 18 | * | .. | .. | .. | Bruce-Peebles. |
| LLANELLY and District .. .. | July, 1911 | 6·25 | 6·75 | 4 | 8½ | 90 G | 11·2 | 60 | 12 | *2 | 2 | Trip.Ex. | .. | British T-H. |
| LONDON County Council (2) .. | May, 1903 | 148·56 | 287·35 | 4 | 8½ | 105 G | 10·6 | 45 | 1725M 150T | 8 | 8 | V. Cp. C. Turbine | 43,000 | Dick, Kerr, & Co. / Westinghouse |
| LONDON United Tramways Co. .. | April, 1901 | 55·25 | 102·45 | 4 | 8½ | 92½ & 100 G | 18 | 28 | 339 | 7 | 5 | V. Cp. | 3,500 | British T-H. / Westinghouse. / Blackwell & Co. |
| LOWESTOFT Corporation .. .. | July, 1903 | 4·75 | 5·07 | 3 | 6 | 100 G | 27 | 36 | 19 | *5 | 5 | Cp. | .. | Blackwell & Co. |
| LUTON Corporation Tramways .. (Leased to J. G. White & Co., Ltd.) | Feb., 1908 | 5·25 | 6·25 | 4 | 8½ | 95 G | 11 | 35 | 12 | *1 | 1 | .. | .. | J. G. White & Co. / British T-H. |
| MAIDSTONE Corporation .. .. | July, 1904 | 5·5 | 7·04 | 3 | 6½ | 96 G | 9 | 35 | 19 | 3 | 3 | .. | 750 | Dick, Kerr & Co. |
| MANCHESTER Corporation .. .. | June, 1901 | 120·05 | 244 | 4 | 8½ | 105 G | 14·9 | 35 | 685 | *22 | 22 | Turb'nes | 45,300 | British T-H. / Dick, Kerr, & Co. |
| MANSFIELD and DISTRICT Co. .. | July, 1905 | 10 | 12·25 | 4 | 8½ | 90 G | 17 | 50 | 24 | *3 | 3 | .. | .. | |
| MERTHYR .. .. .. .. | April, 1901 | 3·69 | 4·81 | 3 | 6 | 96 G | 11 | 66 | 16 | *4 | 4 | H.S.V. | .. | D. K. & B. T-H. |
| METROPOLITAN Electric Trys., Ltd. | July, 1904 | 56·25 | 112·5 | 4 | 8½ | 100 G | 12 | 40 | 312 | 5 | 5 | 1 Stm. Tur | .. | British T-H. / Brush Co. |
| MEXBOROUGH & SWINTON Trys. Co. | Feb., 1907 | 7·75 | 10·75 | 4 | 8½ | 90 G | 8·5 | 55 | 20 | 4 | 4 | Turb. | 700 | Brush & B.T-H. |
| MIDDLESBRO', STOCKTON, & THORNABY Electric Tramways Co. | July, 1898 | 10·5 | 15·825 | 3 | 6 | 92½ G | 17 | 35 | 60 | 3 | 4 | H.&V.Cp. | 900 | British T-H. / Blackwell & Co. |
| MIDDLESEX County Council.. .. | Aug., 1904 | 25·5 | 51 | 4 | 8½ | .. | .. | .. | .. | .. | .. | .. | .. | |
| MIDDLETON Corporation .. .. | March, 1902 | 2·5 | 5 | 4 | 8½ | .. | .. | .. | .. | .. | .. | .. | .. | |
| MIDDLETON Electric Traction Co. .. | March, 1902 | 8·5 | 10·53 | 4 | 8½ | 90 G | 15 | 49½ | 28 | 3 | 3 | .. | 500 | Glover & Co. |
| MORECAMBE .. .. .. .. | Jan., 1912 | 1·20 | .. | 4 | 8½ | 96 G | 18 | .. | 4 | .. | .. | .. | .. | |
| MUSSELBURGH and District .. | Dec., 1904 | 6·5 | 8·125 | 4 | 8½ | 90 G | 34 | 45 | 16 | 4 | 3 | .. | 400 | B. T-H. Co., Nat. Elec. Cons. Co. |
| NELSON Corporation .. .. .. | Feb., 1903 | 2·74 | 3·86 | 4 | 0 | 106 G | 11 | 41 | 11 | *4 | 4 | .. | 400 | Blackwell & Co. / British T-H. Co. / Brush Co. |
| NEW ST. HELENS & DISTRICT Trys. Co. | July, 1899 | 18 | 20 | 4 | 8½ | 95 G | 13 | 35 | 36 | *4 | 4 | V. Cp. C. | .. | Westinghouse / British T-H. |
| NEWCASTLE Corporation .. .. | Dec., 1901 | 32·75 | 69·5 | 4 | 8½ | 101 G | 11 | 37 | 220M 2 T | 6 | 6 | V.Cp.Trip. Ex.&Turb. | 11,000 | Westinghouse / British T-H. |
| NEWPORT (MON.) Corporation .. | April, 1903 | 7·5 | 14·35 | 4 | 8½ | 98 G | 10·5 | 40 | 44 | 5 | 5 | V. Cp. | 1,750 | Westinghouse |
| NORTHAMPTON Corporation .. .. | July, 1904 | 6·5 | 12·5 | 3 | 6 | 90 & 96 G | 18 | 50 | 33 | 4 | 4 | V.C.C.&T | 1,020 | Dick, Kerr, & Co. / Brush Co. |
| NORTH SHIELDS Tramways Co. .. | March, 1901 | .. | 7·75 | 3 | 6 | 90 G | 10 | 36 | 22 | | | | | |
| NORTH STAFF. Trys. (*vide* Potteries) | | | | | | | | | | | | | | |
| NORWICH Electric Tramways Co. .. | July, 1900 | 14·5 | 19·25 | 3 | 6 | 65½ & 90 G | 12·6 | 38 | 42 | 6 | 5 | H.TCp&T | 1,000 | Westinghouse / Blackwell & Co. |
| NOTTINGHAM Corporation .. .. | Jan., 1901 | 21·5 | 40·3 | 4 | 8½ | 107 G | 11·5 | 40 | 155 | *3 | 3 | .. | .. | British T-H. / Dick, Kerr, & Co. |
| NOTTINGHAMSHIRE & DERBYSHIRE Tramways Co. .. .. | Aug., 1913 | 12·8 | 16·10 | 4 | 8½ | G | .. | .. | 24 | * | .. | .. | .. | British T-H. |
| OLDHAM, ASHTON & HYDE Trys. Co. | June, 1899 | 9·12 | 11·75 | 4 | 8½ | 97 G | 11 | 28 | 46 | *3 | 3 | V.Cp.C. | .. | British T-H. |
| OLDHAM Corporation .. .. .. | Dec., 1900 | 24 | 37 | 4 | 8½ | 100 & 105 G | 10·5 | 40 | 109 | *4 | 4 | .. | 2,220 | Dick, Kerr, & Co. |
| PAISLEY & DISTRICT Tramways Co. | June, 1904 | 18·25 | 32·50 | 4 | 7¾ | 90 G | 10 | 34 | 60 | .. | .. | .. | .. | British T-H. |
| PERTH Corporation .. .. .. | Oct., 1905 | 4·846 | 6·75 | 3 | 6 | 90 G | 16 | 25 | 12 | 5 | 5 | Cp. | 500 | Blackwell & Co. |
| PETERBOROUGH Elec. Traction Co... | Jan., 1903 | 5·33 | 6·71 | 3 | 6 | 94 G | 31 | 35 | 14 | .. | .. | .. | .. | Blackwell & Co. / Dick, Kerr, & Co. |
| PLYMOUTH Corporation .. .. | Sept., 1899 | 7·75 | 15 | 3 | 6 | 92 G | 9 | 35 | 42 | 3 | 3 | V. Cp. | .. | Elec. Cons. Co. / Westinghouse |
| PLYMOUTH, STONEHOUSE, and DEVONPORT .. .. .. | Nov., 1901 | 1·5 | 3·62 | 3 | 6 | 84 G | 11 | 34 | 15 | .. | .. | .. | .. | Blackwell & Co. / Dick, Kerr, & Co. |
| PONTYPRIDD URBAN DISTRICT .. | March, 1905 | 5·5 | 8·6 | 3 | 6 | 96 & 100 G | 10 | 27·6 | 26 | 4 | 5 | V.C.Cp. | 450 | B.I.W. & B.T-H. / Blackwell & Co. |
| PORTMADOC & SOUTH SNOWDON Rly. | Under cons. | 13·25 | 15 | 1 | 11½ | 41 | 28 | 200 | 6 | .. | .. | .. | .. | |
| PORTSDOWN & HORNDEAN Tramway | March, 1903 | 6 | 7·5 | 4 | 7¾ | 96 G | 16 | 40 | 16 | 2 | 2 | Oil | 200 | Dick, Kerr, & Co. / Brush Co. |
| PORTSMOUTH Corporation .. .. | Sept., 1901 | 17·65 | 34·63 | 4 | 7¾ | 96 & 100 G | 17 | 35 | 100 | 5 | 4 | V.& H.Cp. | 2,075 | Macartney & Co. / Dick, Kerr, & Co. |
| POTTERIES Electric Traction Co. .. | May, 1899 | 31·67 | 41·48 | 4 | 0 | 87, 90, 100, & 110 G | 11 | 45 | 110 | 8 | 8 | H.Cp. V.Cp. | 2,275 | Dick, Kerr, & Co. / Blackwell & B.T-H. |
| PRESTON Corporation.. .. .. | June, 1904 | 10·54 | 17·2 | 4 | 8½ | B.S.S. No. 2 | 16 | 28 | 39 | 2 | 2 | H. Cp. | 600 | Dick, Kerr, & Co. |
| RADCLIFFE URBAN DISTRICT .. | April, 1905 | 5 | 6·5 | 4 | 8½ | 100 G | 15 | 40 | .. | *4 | 4 | V. Cp. | 600 | Mather & Platt |
| RAWTENSTALL Corporation .. .. | May, 1909 | 12 | 15·9 | 4 | 0 | 100 G | 15 | 38 | 24 | *3 | 3 | .. | 850 | Westinghouse |
| READING Corporation .. .. .. | July, 1903 | 7·44 | 13·175 | 4 | 0 | 96 G | 16 | 35 | 36 | 4 | 4 | V. Cp. | 400 | Blackwell & Co. / Dick, Kerr, & Co. / Westinghouse |
| RHONDDA Tramways Co. .. .. | July, 1908 | 21 | 28·75 | 3 | 6 | 95 G | 9 | 38½ | 54 | 7 | 4 | Trip.Ex. | 1,230 | British T-H. / Brush |
| ROCHDALE Corporation .. .. | May, 1902 | 19·58 (A) | 40 (A) | 4 | 8½ | 103½ G | 11·7 | 30 | 69 | * | .. | .. | .. | British T-H. / Dick, Kerr, & Co. / Brush Co. |
| ROTHERHAM Corporation .. .. | Jan., 1903 | 10 | 12 | 4 | 8½ | 100 G | 9·5 | 45 | 36 | *6 | 6 | H.S.Cp. | 1,485 | Dick, Kerr, & Co. |
| ROTHESAY .. .. .. .. | June, 1902 | 4·81 | 9·68 | 3 | 6 | 94 G / 77 G | 24 | 34 | 20 | 3 | 3 | V. & Oil | 350 | Dick, Kerr, & Co. / Westinghouse |
| RYDE PIER, ISLE OF WIGHT Ryde Pier Co. (3) .. | March, 1886 | ·5 | 1 | 4 | 8½ | 30 & 34 V | .. | .. | 4 | 2 | 2 | Gas | .. | Siemens Bros. |
| SALFORD Corporation .. .. | Oct., 1901 | 41·90 | 75·79 | 4 | 8½ | 103 G | 20 | 42·5 | 220 | *7 | 7 | C. & Turb. | 3,000 | Westinghouse / Mather & Platt |
| SCARBOROUGH Tramways Co. .. | May 1904 | 5 | 7·75 | 3 | 6 | 90 G | 10·5 | 35 | 22 | 2 | 2 | Stm. Turb. | .. | Brush & B.T-H. |
| SHEERNESS and District .. .. | April, 1903 | 2·5 | 2·704 | 3 | 6 | 94 G | 43 | 40 | 8 | 6 | 5 | V.Cp.C. | 100 | Siemens & Halske / Brush Co. |
| SHEFFIELD Corporation .. .. | Sept., 1899 | 40 | 77·84 | 4 | 8½ | 110 & 120 | 9·5 | 35 | 339 | .. | .. | .. | .. | British T-H. |

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines. Besides the electric lines the London County Council has also 4·45 route miles of horse tramways. (3) Third rail system. (A) Not including 17·1 miles track leased.
M—Motor Cars. T—Trail Cars.

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| ELECTRIC TRAMWAYS (contd.). | Date of Opening of First Section. | Length of Route. | Total Length of Track. | Gauge. ft. | Gauge. in. | Weight and Type of Rail | Maximum Gradient. | Sharpest Curve. | No. of Motor Cars. | No. of Dynamos | No. of Engines | Type of Engines. | Total Capacity Traction, kw. | Principal Contractors for Electrical Equipment. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | lbs. | 1 in | ft. rad. | | | | | | |
| SHIPLEY URBAN DISTRICT .. .. | May, 1902 | 6 | 10 | 4 | 0 | 98 G | 15 | .. | .. | 6 | 6 | Turbine | 1,800 | British T-H. |
| SOOTHILL NETHER U.D.C. & DEWSBURY & OSSETT CORPORATIONS .. | Nov., 1908 | 3·125 | 4·45 | 4 | 8½ | 90 G | 13 | 50 | 8 | * | .. | .. | .. | Nat. Elec. Cons. Co. |
| SOUTHAMPTON Corporation .. .. | Jan., 1899 | 10·25 | 18·75 | 4 | 8½ | 96 G & 105 B.S.No.4 | 13 | 40 | 73 | 6 | 6 | H.Cp.C. | 1,000 | Westinghouse |
| SOUTHEND Corporation .. .. | July, 1901 | 7·01 | 15·2 | 3 | 6 | 90 G | 18 | 48 | 42 | *6 | 7 | V.Cp. | 2,075 | British T-H. |
| SOUTHEND PIER (1) Southend Corp. | Aug., 1890 | 1·25 | 1·25 | 3 | 6 | 60 G | Lev. | .. | 28 | .. | .. | .. | .. | British T-H. |
| SOUTH METROPOLITAN Elec. Try. Co. | Feb., 1906 | 13·09 | 26 | 4 | 8½ | 95 G | 16 | 42 | 51 | *8 | 6 | Stm Tbs | 1,650 | Dick, Kerr & Co. Brush Co. |
| SOUTHPORT Corporation .. .. | July, 1900 | 13·5 | 10·75 | 4 | 8½ | 87 & 90 G | 25 | 45 | 30 | *3 | 3 | H. Cp. | 600 | Dick, Kerr, & Co. |
| SOUTHPORT Electric Tramway Co... | July, 1901 | 8·17 | 12·52 | 4 | 8½ | 87 G | Nil | 40 | 21 | * | | | | |
| SOUTHPORT PIER .. .. .. | 1905 | .. | ·75 | 4 | 0 | .. | .. | .. | 1 M 2 T | .. | .. | .. | .. | Westinghouse |
| SOUTH SHIELDS Corporation .. | March, 1906 | 5·7 | 10·25 | 4 | 8½ | 95 G | 15 | 35 | 40 | 2 | 2 | V.Cp.C. | 1,100 | Dick, Kerr & Co. |
| SOUTH STAFFORDSHIRE .. .. | Jan., 1893 | 16·90 | 26·87 | 3 | 6 | 97 & 90 G | 17 | 46 | 46 | 3 | 3 | C.H.Cp. | .. | Blackwell & Co. E. C. C. |
| STALYBRIDGE, HYDE, MOSSLEY, and DUKINFIELD .. .. | May, 1904 | 21·186 | 27·75 | 4 | 8½ | 99 G | 9 | 27½ | 59 | 8 | .. | Turb. | 1,000 | Dick, Kerr, & Co. |
| STOCKPORT Corporation .. .. | Aug., 1901 | 16 | 27·62 | 4 | 8½ | 96 G | 10·8 | 35 | 50 | *5 | 5 | Cp. | 1,000 | Dick, Kerr, & Co. |
| SUNDERLAND Corporation .. .. | Aug., 1900 | 10·92 | 20·35 | 4 | 8½ | 96 G | 12 | 36 | 70 | * | .. | .. | 936 | Dick, Kerr, & Co. |
| SUNDERLAND District Electric Trys. | June, 1905 | 14·27 | 15·97 | 4 | 8½ | 90 G | 11 | 40 | 33 | * | .. | .. | .. | British T-H. |
| SUTTON & HOWTH (G.N.R., Ireland) | June, 1901 | 5·3 | 6 | 5 | 3 | 72 B | 16·7 | 300 | 11 | 3 | 3 | V.Cp. | 500 | British T-H. Westinghouse |
| SWANSEA Tramways Company .. | June, 1900 | 13·02 | 20·38 | 4 | 8½ | 84 & 86 G | 14 | 45 | 75 | * | .. | .. | .. | British T-H. |
| SWINDON Corporation .. .. | Sept., 1904 | 3·7 | 4·4 | 3 | 6 | 105 G | 14 | 37 | 12 | 5 | 4 | .. | 600 | Dick, Kerr & Co. |
| TAUNTON ELECTRIC TRACTION Co. | Aug., 1901 | 1·66 | 2 | 3 | 6 | 90 G | 25 | 35 | 6 | * | .. | .. | .. | Blackwell & Co. |
| TORQUAY Tramways .. .. .. | April, 1907 | 9·76 | 17·04 | 3 | 6 | 90 G | 10 | 31 | 33 | * | .. | .. | .. | British T-H. |
| TRAFFORD PARK Estates, Ltd. (Trys.) | July, 1903 | 2·5 | 2·75 | 4 | 8½ | 100 G | Nil | 35 | .. | .. | .. | .. | .. | |
| TYNEMOUTH and DISTRICT .. .. | March, 1901 | 4·21 | 7·83 | 3 | 6 | 90 G | 10 | 30 | 21 | *3 | 3 | .. | .. | Blackwell & B.T-H. |
| TYNESIDE Tramways & Tramroads Co. | Sept., 1902 | 10·97 | 16·23 | 4 | 8½ | 95 G | 10 | 40 | 24 | * | | | | |
| WALLASEY Corporation .. .. | March, 1902 | 12 | 20 | 4 | 8½ | 98 G | 11 | 40 | 67 | *1 | 1 | Turbine | 1,000 | Blackwell & Co. |
| WALSALL Corporation .. .. | Jan., 1904 | 13·5 | 19·5 | 3 | 6 | 90 & 92 G | 18·5 | 32 | 39 | *7 | 7 | V.& Tur. | 2,490 | British T-H. |
| WALTHAMSTOW U.D.C. Light Rly... | June, 1905 | 9·14 | 12·53 | 4 | 8½ | 100 G | 18 | 40 | 38 | *15 | 12 | Gas & Turb's | 1,560 | Westinghouse |
| WALTON-ON-NAZE PIER .. .. | Aug., 1898 | ·5 | ·5 | 3 | 6 | 36 V | .. | .. | 3 | 3 | 2 | .. | 100 | Blackwell & Co. |
| WARRINGTON Corporation .. .. | April, 1902 | 6·5 | 9·6 | 4 | 8½ | 90 G | 27 | 50 | 21 | *6 | 6 | V.C. | 500 | British T-H. |
| WEMYSS and DISTRICT .. .. | Aug., 1906 | 7·5 | 13 | 3 | 6 | 95 & 97 G | 18 | 85 | 17 | 3 | 3 | 2 V.Cp. | .. | BrucePeebles&Co. |
| WEST BROMWICH Corporation .. | Dec., 1902 | 7 | 12·5 | 3 | 6 | 98 G | 20 | 49 | 29 | 8 | 8 | Turb'nes | 750 | Dick, Kerr, & Co. B. I. W. Co. |
| WEST HAM Corporation .. .. | Feb., 1904 | 16·8 | 30·0 | 4 | 8½ | 100 G | 18 | 40 | 118 | *3 | 3 | V.C.Cp. | 1,500 | Brush & B.T-H. |
| WEST HARTLEPOOL Corporation .. | May, 1896 | 6·72 | 8.3 | 3 | 6 | 87 & 90 G | 15 | 35 | 25 | * | .. | .. | .. | Elec. Cons. Co. Dick Kerr & Co. |
| WESTON-SUPER-MARE .. .. | May, 1902 | 2·92 | 3·53 | 4 | 8½ | 90 G | 25 | 40 | 12 | 5 | 4 | Cp. & T. | .. | Blackwell & Co. British T-H. Brush Co. |
| WIGAN Corporation .. .. .. | Jan., 1901 | 30·9 | 45·42 | 3 4 | 6 8½ | 105 G | 12 | 45 | 73 | *8 | 8 | .. | 740 | Blackwell & Co. |
| WOLVERHAMPTON Corporation (3) .. | April, 1902 | 13·5 | 22 | 3 | 6 | 91 G | 15 | 37·5 | 52 | *10 | 10 | H.&V.C. & Turb's | 2,900 | British T-H. Electric Cons. Co. |
| WOLVERHAMPTON DISTRICT .. .. | Oct., 1900 | 15·51 | 22·72 | 3 | 6 | 90 G | 20 | 40 | 30 | *4 | .. | .. | .. | B.I.W. & B.T-H. Westinghouse |
| WORCESTER Electric Traction Co. .. | Feb., 1904 | 5·86 | 8·58 | 3 | 6 | 94 G | 13 | 45 | 15 | *3 | 3 | .. | .. | Brush Co. Dick, Kerr, & Co. |
| WREXHAM and DISTRICT .. .. | April, 1903 | 4·44 | 6·16 | 3 | 6 | 96 G | 9·11 | 50 | 10 | *6 | .. | .. | .. | British T-H. |
| YARMOUTH Corporation .. .. | June, 1902 | 10 | 14·4 | 3 | 6 | 90 & 95 G | 27 | 48 | 35 | 3 | 3 | Comp. | .. | Brush Co. B.I.W. Co. |
| YORK Corporation .. .. .. | Jan., 1910 | 6 | 9·9 | 3 | 6 | 100 | 18 | 40 | 3 M. 4 T. | *8 | 8 | V.C. | .. | Dick, Kerr, & Co. Brush & B.T-H. |
| YORKSHIRE (West Riding) .. .. | Aug., 1904 | 24·69 | 40·382 | 4 | 8½ | 96 G | 15·5 | 40 | 69 | 9 | 6 | .. | 1,800 | Dick Kerr & Co. |
| YORKSHIRE WOOLLEN DISTRICT .. | Feb., 1903 | 22·25 | 36 | 4 | 8½ | 94 & 100 G | 8 | 30 | 69 | * | .. | .. | .. | Brush Co. Dick, Kerr, & Co. |
| **RAILWAYS.** | | | | | | | | | | | | | | |
| **LONDON AND VICINITY:** | | | | | | | | | | | | | | |
| CENTRAL LONDON RLY. Co. (1) .. | July, 1900 | 6·5 | 13 | 4 | 8½ | 100 V | 30 | .. | 68 M. 172 T. | 6 | 6 | H.Cp.C. | .. | British T-H |
| CITY & SOUTH LONDON RLY. Co. (1 | Dec., 1890 | 7·25 | 14·75 | 4 | 8½ | 60 V 80 V | 30 | 120 | 52 L. 142 T. | (a) | .. | .. | .. | Mather & Platt. Elec. Cons. Co. British T-H. |
| EAST LONDON RAILWAY (2) .. | April, 1913 | 5·75 | 11·5 | 4 | 8½ | 90 B | .. | .. | (c) | .. | .. | .. | .. | |
| GT. NORTHERN & CITY RLY. Co. (2) | Feb., 1904 | 3·5 | 7·75 | 4 | 8½ | 85 V | 52 | 660 | 35 M 45 T | 6 | .. | .. | .. | British T-H. |
| GREAT WESTERN RAILWAY .. (Hammersmith and City line.) (2) | Nov., 1906 | 4·9 | 10·5 | 4 | 8½ | 97½ B | 60 | 400 | 46 M. 80 T | 10 | 10 | V.Cp. | .. | British T-H. Elec. Con. Co. |
| LONDON & NORTH WESTERN RLY. (Euston-Watford line in progress) (2) | May, 1914 | 41·5 | 80 | 4 | 8½ | .. | .. | .. | .. | .. | .. | Turbine | .. | Siemens Works Westinghouse |
| LONDON & SOUTH WESTERN RLY. | Nov., 1915 | 47 | 150 | 4 | 8½ | .. | .. | 168 | 84 | .. | .. | Turbine | .. | Dick, Kerr & Co. British T-H. |
| LONDON, BRIGHTON, and SOUTH COAST RAILWAY (4) .. .. (Extensions in progress) | Dec., 1909 | 22 | 70 | 4 | 8½ | .. | .. | .. | 16 M. 8 T. | *(d) | .. | .. | .. | Westinghouse British T-H. Blackwell & Co. |
| LONDON ELECTRIC RAILWAY Co.: BAKER ST. & WATERLOO RY. (2) | March, 1906 | 7 | 14·0 | 4 | 8½ | 90 B | 60 | 330 | 36 M. 72 T. | (a) | .. | .. | .. | Westinghouse British T-H. |
| CHARING CROSS—HAMPSTEAD RAILWAY (2) .. .. | June, 1907 | 8 | 16·5 | 4 | 8½ | 90 B | 33 | 330 | 60 M. 90 T. | (a) | .. | .. | .. | Westinghouse British T-H. |
| GREAT NORTHERN, PICCADILLY & BROMPTON RLY. (2) | Dec., 1906 | 9·25 | 18·5 | 4 | 8½ | 90 B | 33 | 330 | 72 M. 144 T. | (a) | .. | .. | .. | Westinghouse British T-H. |
| METROPOLITAN RAILWAY (2) .. | Jan., 1905 | 33 | 59 | 4 | 8½ | 86 B | 44 | 363 | 86 M. 172 T. | 4. | 4 | Turbine | .. | Westinghouse British T-H. |
| METROPOLITAN DISTRICT RAILWAY (and running powers) (2) | July, 1905 | 41 | 80·46 | 4 | 8½ | 86 B | 40 | 330 | 284 M. 286 T. | (a) | .. | Turbine | .. | British T-H. Westinghouse |
| WATERLOO AND CITY RLY. (1) .. | Aug., 1898 | 1·5 | 3 | 4 | 8½ | 87 B | 30 | 321 | 17 M. 12 T. | 6 | 6 | V. C. | .. | Siemens Bros. Dick, Kerr & Co. |
| **PROVINCES:** | | | | | | | | | | | | | | |
| LANCASHIRE AND YORKSHIRE (2) .. | March, 1904 | 43 | 85 | 4 | 8½ | 86 B | 85 | 840 | 78 M. 52 T. | 6 | 5 | 1 V.C. 4 H.C. | .. | Dick, Kerr, & Co. |
| Ditto (5) .. | | 22 | .. | 4 | 8½ | 86 B | .. | .. | 30 M. | .. | .. | .. | .. | Dick, Kerr, & Co. |
| LIVERPOOL OVERHEAD RLY. Co. (1) | March, 1893 | 6·5 | 13·05 | 4 | 8½ | 60 V | 40 | 429 | 46 M 7 T | 7 | 7 | H.Cp. V.Cp. | .. | Electric Cons. Co. Dick, Kerr, & Co. |
| MERSEY RAILWAY (1) .. .. | April, 1903 | 4·5 | 9 | 4 | 8½ | 86 B | 27 | 528 | 24 M. 37 T. | 5 | 5 | V.Cp. | .. | Westinghouse |
| MIDLAND RLY.—MORECAMBE AND HEYSHAM BRANCH (4) | June, 1908 | 9·75 | 19·5 | 4 | 8½ | .. | .. | .. | 3 M. 6 T. | 4 | 4 | Gas. | .. | Westinghouse Siemens Bros. |
| NORTH EASTERN RAILWAY (1) .. | March, 1904 | .. | .. | 4 | 8½ | 90 B | .. | .. | .. | (b) | .. | .. | .. | British T-H. Co. |

* Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase. (5) Third rail system—1,200 volts D.C. (a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited. (c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation.
M—Motor Cars. T—Trail Cars.

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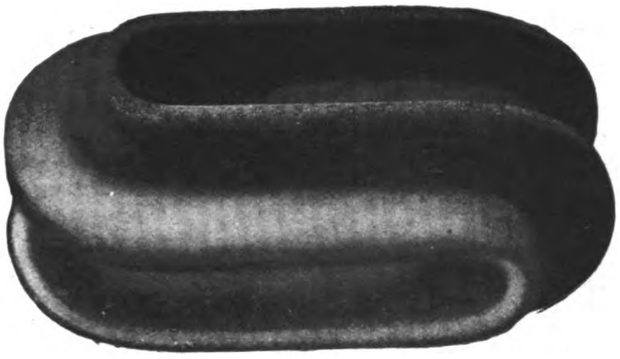
# PRESCOT INSULATORS



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They are designed to maintain their alignment when erected, and their mechanical and electrical factors of safety are high.

**The following are particulars of the sizes stocked:**

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|---|---|---|
| Working Load ... ... ... | 500 lbs. | 2,500 lbs. |
| Breaking Load ... ... ... | 2,000 lbs. | 10,000 lbs. |
| Flash over Voltage (dry) ... ... | 20,000 A.C. | 30,000 A.C. |
| Flash over Voltage (wet) ... ... | 2,000 A.C. | 10,000 A.C. |

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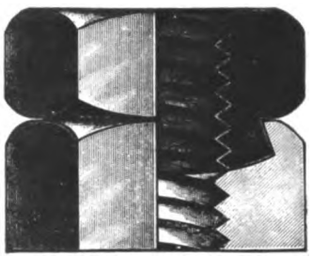


SECTIONAL VIEW

# The Triple Lock

—EACH SEPARATE, BUT SIMULTANEOUS AND INTERDEPENDENT—OF

# VISLOK

**Firstly:** The Lower Half being held stationary while another spanner rotates the Upper Half to effect the Lock, the obvious result is to alter the thread pitch in the latter. Hence such threads are caused to act as a number of wedges, thus taking up all slack between Vislok and Bolt.

**Secondly:** The natural tendency of the Upper Half to follow the pitch of the bolt thread brings its base into contact with the conical formation of the Lower Half. This forces the swollen extension of Upper Half to close in on and set up an extra circumferential grip on the bolt.

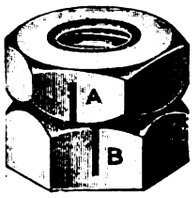
**Thirdly:** Further: the shoulder of the swollen extension of the Upper Half is brought into contact with the undercut wall of the Lower Half, causing it to grip and render the Upper Half immovable.

**Fitted to bolts in the same way as ordinary nuts and with the same tool—a spanner**

**Neither vibration, twisting-strain or successive shocks affect it. That is why it is**

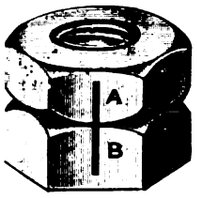
## THE SAFETY LOCK NUT

(PATENT)




LOCKED

**The economy of fitting Vislok is apparent, as it does not damage the bolt threads and can be repeatedly used**




UNLOCKED

**RELIABLE SIMPLE ECONOMICAL**

**During over three year's continuous sales the merits of Vislok have been admitted by numerous prominent concerns. For instance: 1,224 hours on the big-end brasses of a High-speed Steam Engine. You can independently confirm the claims made for Vislok by sending an application for**

***FREE TESTING SAMPLES.***

*Makers and Patentees—*

**VISLOK Ltd., 3, St. Bride's House, London, E.C. 4.**

Prepared by HADDON ADVERTISING AGENCY.—V. 104

A SELECTED LIST

**of Tramways where the need of VISLOK has been proved**

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IT IS YOUR NEED ALSO.


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# E & E SERVICE

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WILL KEEP YOU GOING IN

## 1918

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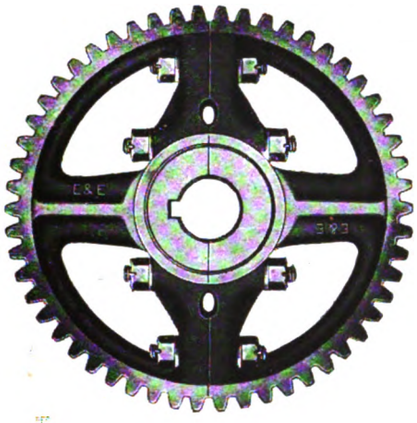
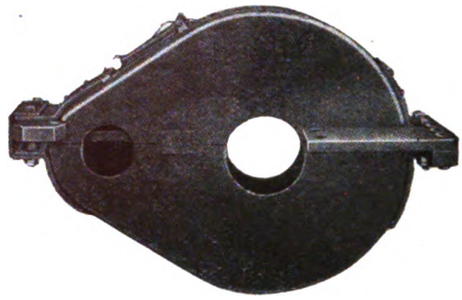
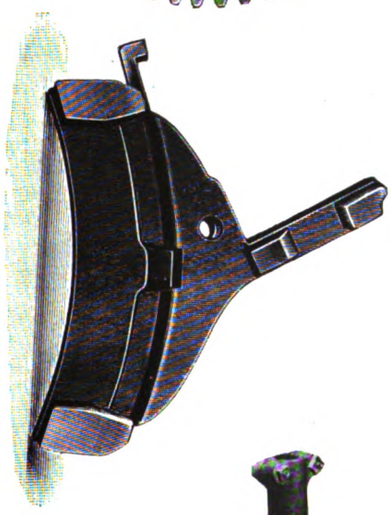
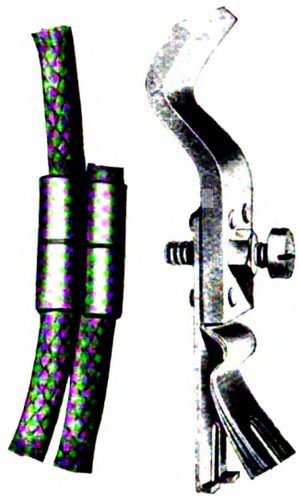


AND ARE PREPARING FOR MORE DIFFICULT PROBLEMS BEFORE US







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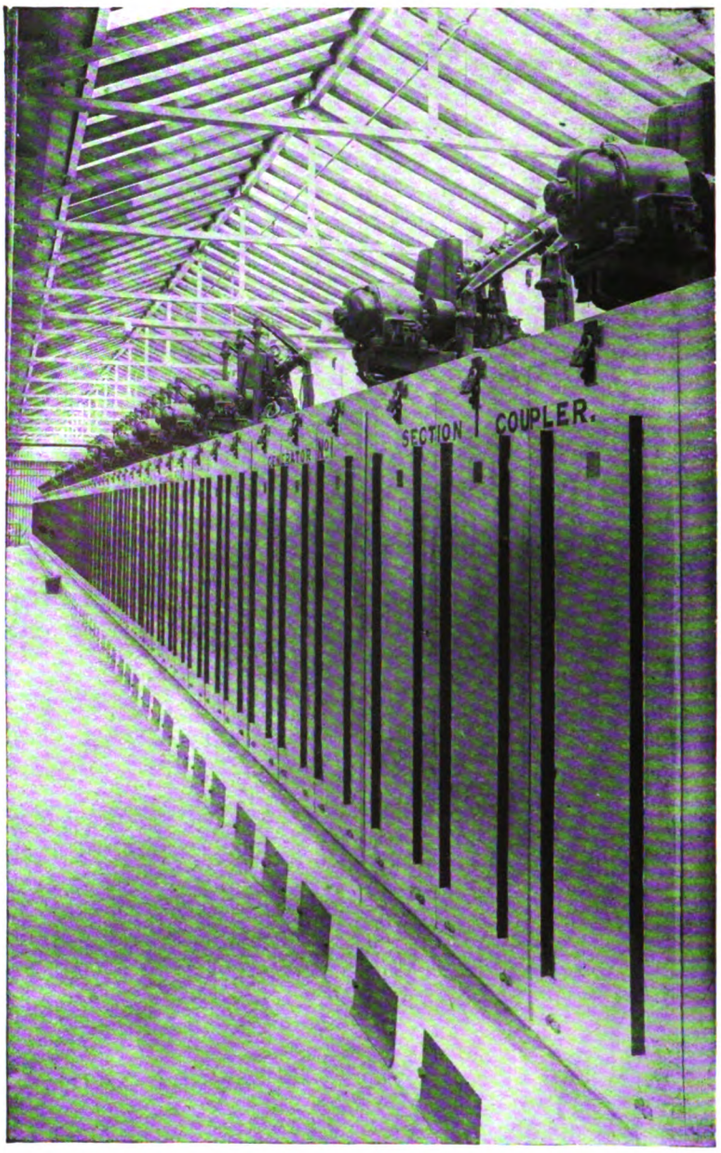


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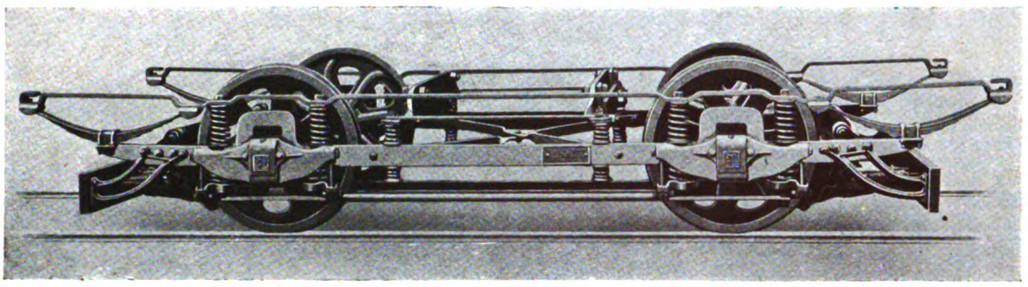

# Brill Swing-Link 21-E Truck (Pat.)

THE Brill swing-link truck brings to the short car the advantages of the swinging bolster of the bogie-truck. Body oscillations on single-truck cars are now counteracted. The heavy shocks and blows at the wheel flange and rail head, due to side thrusts —endwise swinging—and "snaking" of the body, subject passengers to extreme buffetting and discomfort. The swing-link intercepts the rigid thrust of the body, modifying these side shocks, and thus introduces greater flexibility between truckframe and carbody.

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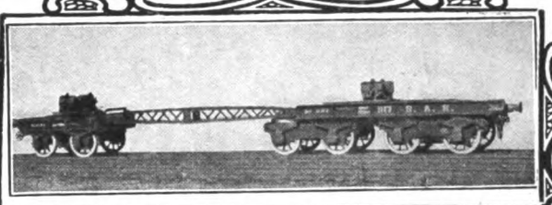

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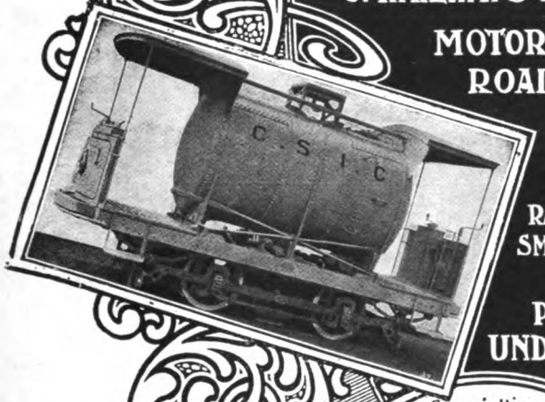

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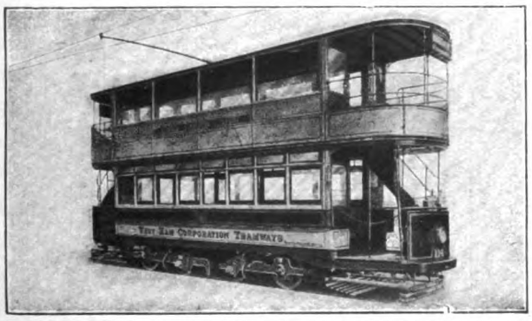

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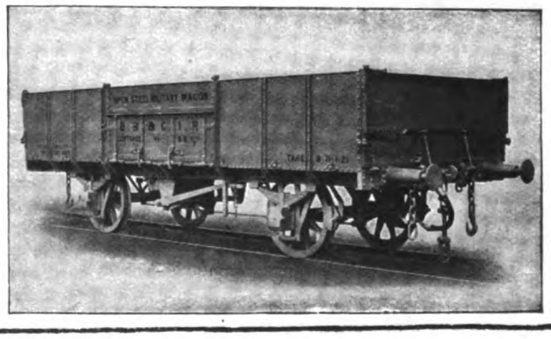

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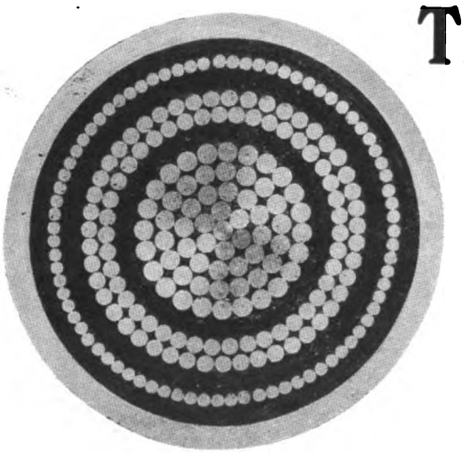

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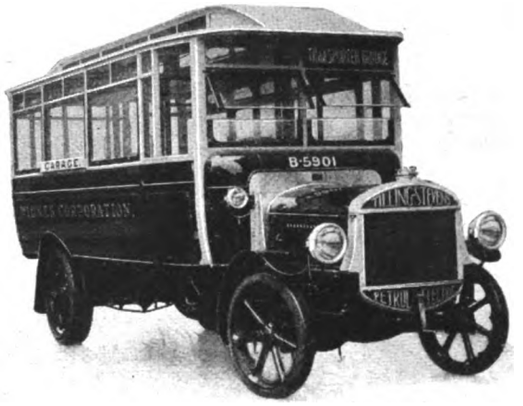


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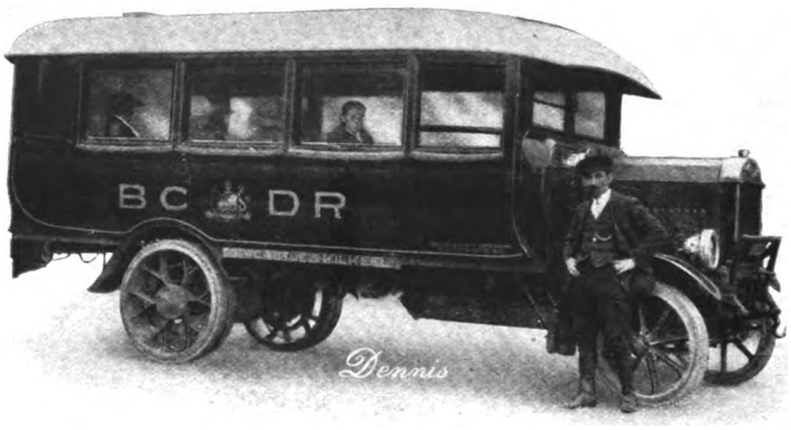


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**[COPY OF TESTIMONIAL]**

NORTON & CO., CAR SERVICE,
CHIEF OFFICE, KILKEEL, CO. DOWN,
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MESSRS. DENNIS BROS. (1913), LTD.,
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I have the pleasure to enclose a photograph of the 'bus. It has been on the road since August, 1916, and except that once the pump went astray, has never given the slightest trouble. The driver, whose photograph appears, deserves some credit for this, as he is, as was put to me this day, married to his car. A resident along the route said to me a short time ago, that he could set his watch by the 'bus, while when at home he was attending to it constantly. He is only a country boy, a resident of the district, with the advantage of about three weeks' motor training, direct from a National School, but always possessing a real mechanical genius, able to clean the neighbours' clocks intuitively. He has excited the wrath of our local motor engineers, by being able to make motor bicycles go that were given up by them as hopeless.

If you have complaints the secret will often be found in the driver's non-attention and non-observance of your instructions.

My experience is that the Dennis is far superior to other makes that we have had—unfortunately.

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(Signed) H. A. MATIER.

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|---|---|---|---|---|---|---|---|---|---|---|
| mm | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| 620 | ... | ... | ... | 7 7 6 | ... | ... | ... | ... | ... | ... |
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| 670 | ... | ... | 6 14 0 | 7 10 6 | 8 8 6 | 9 6 6 | ... | 11 16 0 | 16 4 0 | ... |
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| 701 | ... | ... | ... | 7 15 6 | ... | 9 15 0 | ... | ... | ... | ... |
| 720 | 5 14 6 | 6 17 6 | 7 1 0 | 7 19 0 | 8 17 0 | 9 16 6 | ... | 12 7 6 | 17 2 0 | * |
| 741 | 5 18 0 | ... | ... | ... | ... | 10 1 6 | ... | ... | ... | ... |
| 751 | ... | ... | ... | 8 5 6 | ... | ... | ... | ... | ... | ... |
| 771 | ... | ... | 7 9 0 | 8 8 6 | 9 8 6 | 10 8 0 | ... | 13 10 0 | 18 2 0 | ... |
| 789 | ... | ... | ... | ... | ... | 10 13 0 | ... | ... | ... | ... |
| 850 | ... | ... | ... | 9 3 6 | 10 3 0 | 11 6 0 | 12 13 0 | 14 5 0 | 19 13 0 | * |
| 868 | ... | ... | ... | ... | ... | ... | ... | 14 16 6 | ... | ... |
| 871 | ... | ... | ... | ... | ... | ... | ... | ... | 20 3 0 | ... |
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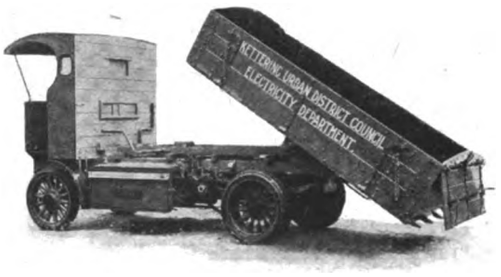


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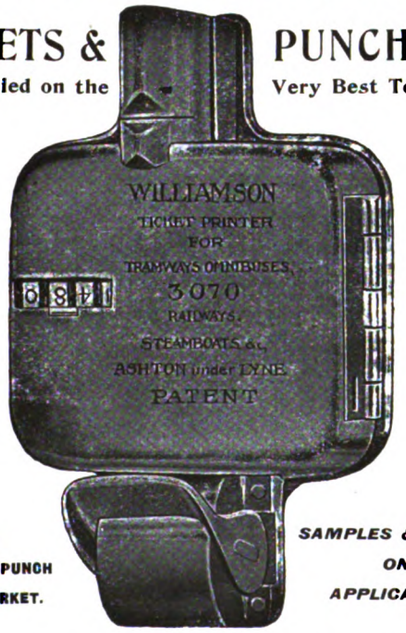


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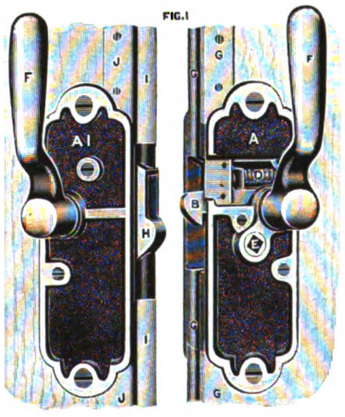
FIG. 1



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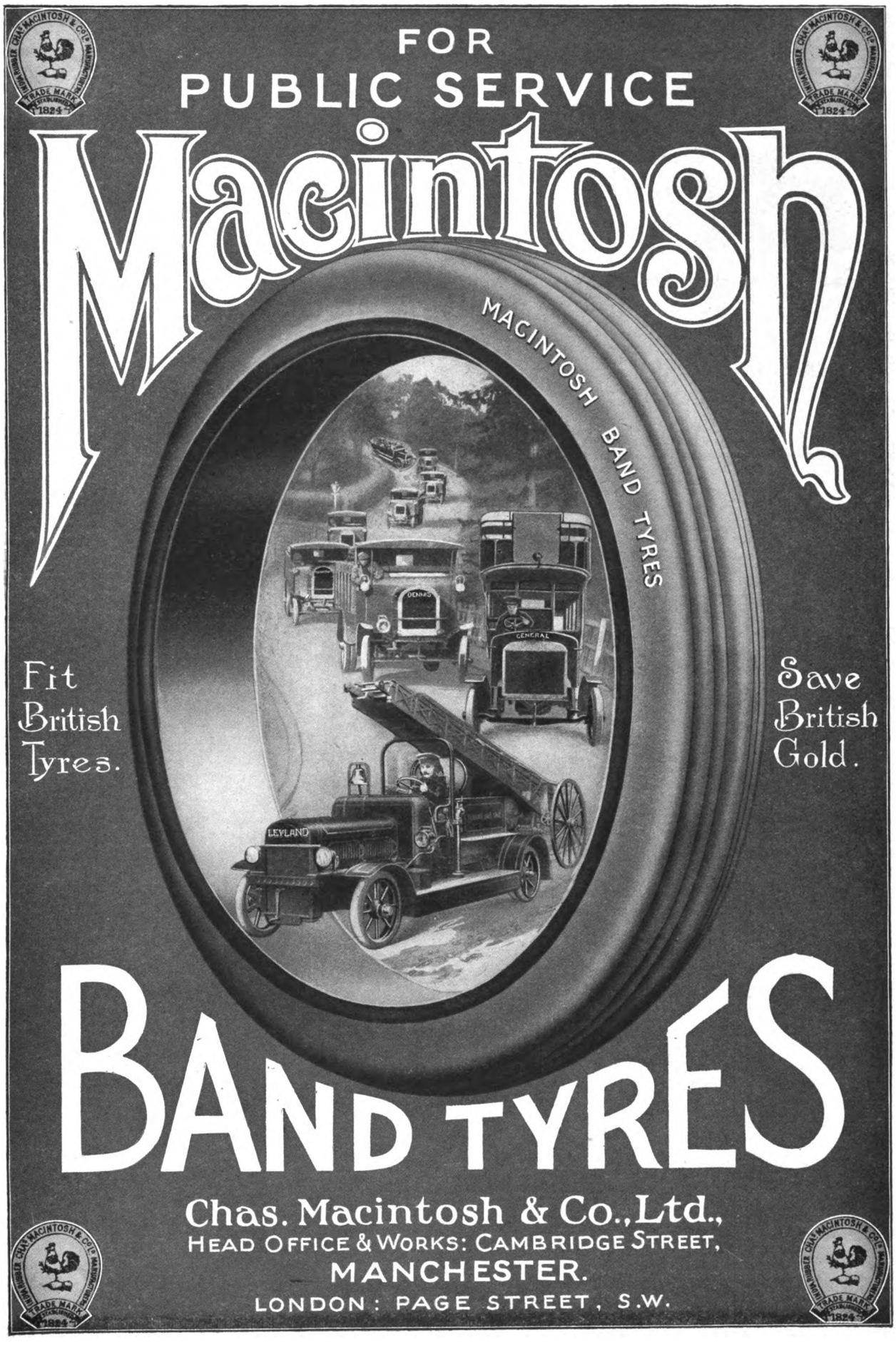


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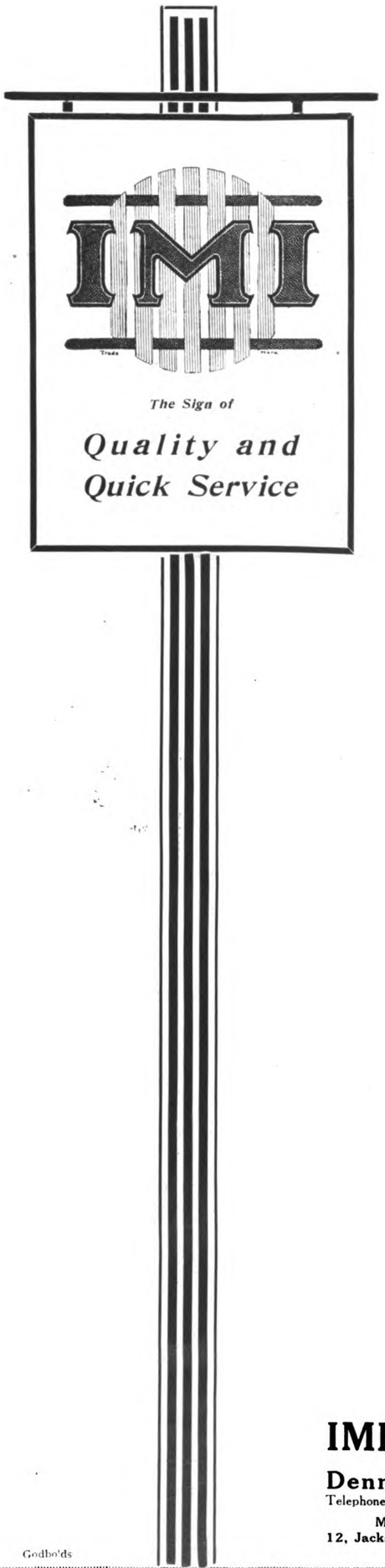


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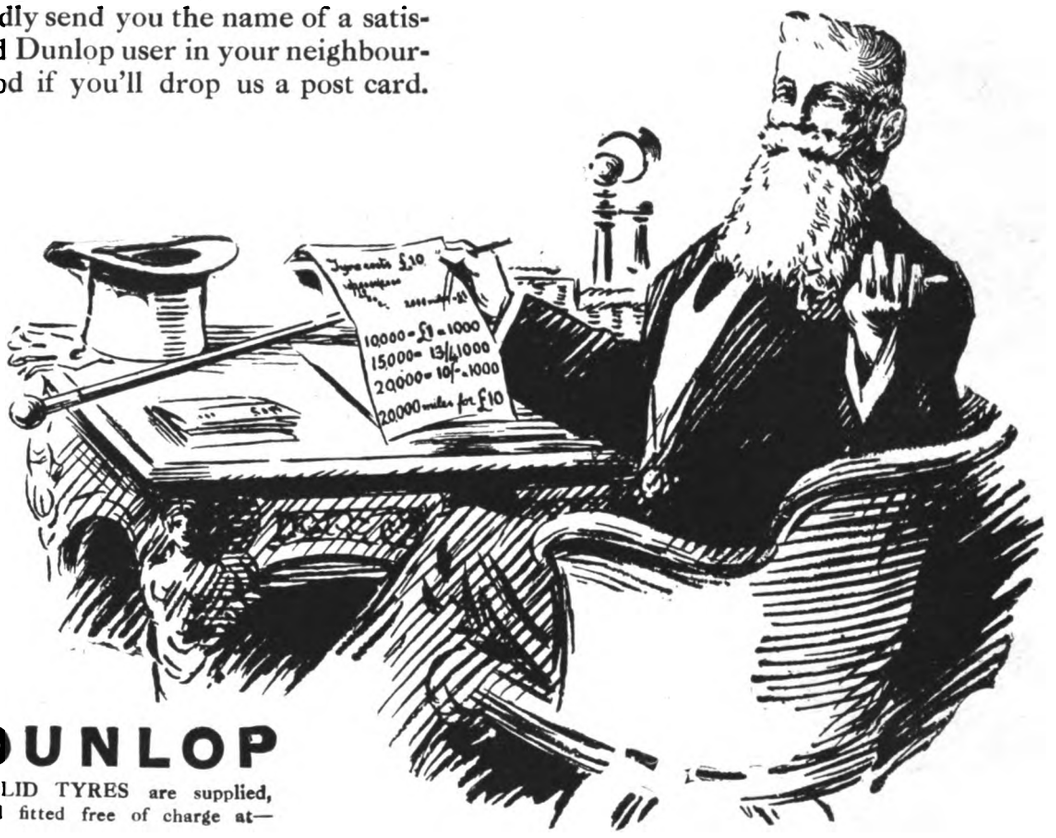


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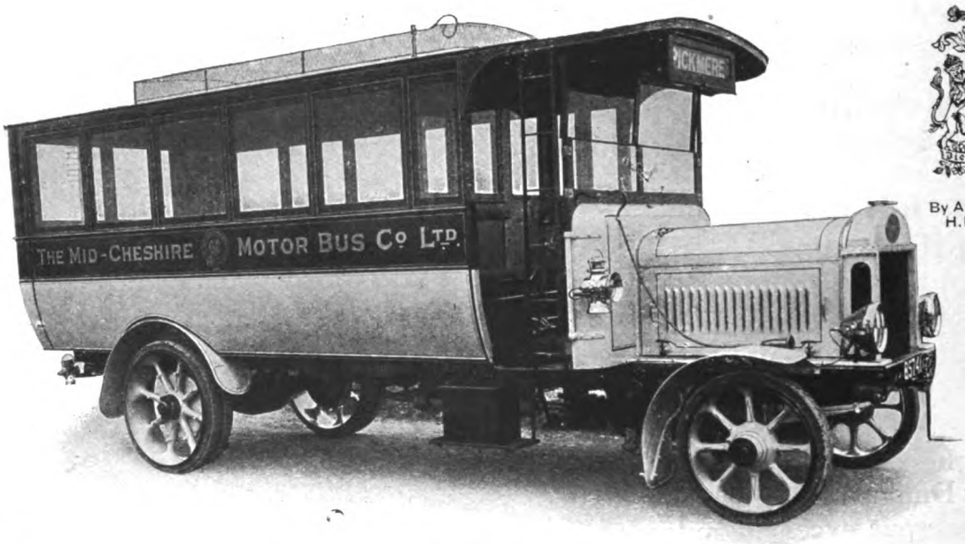


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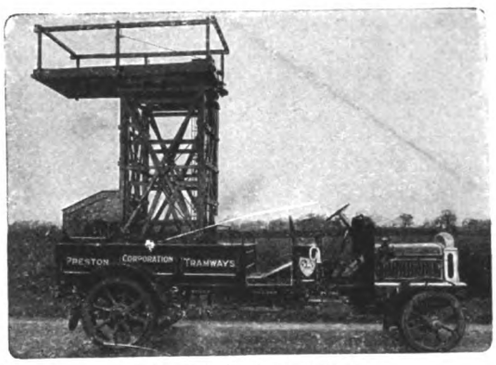


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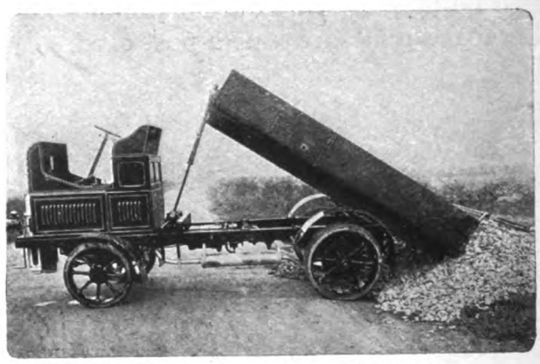

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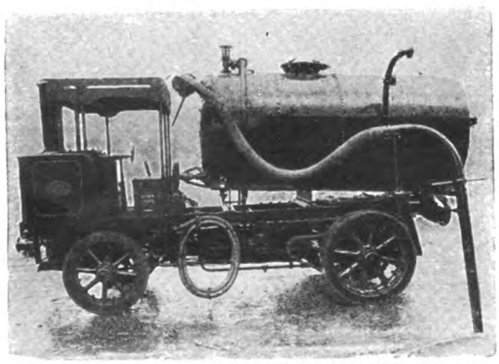

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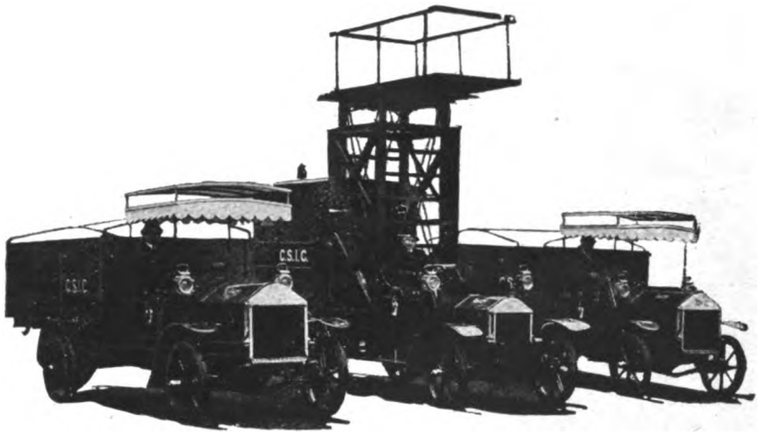

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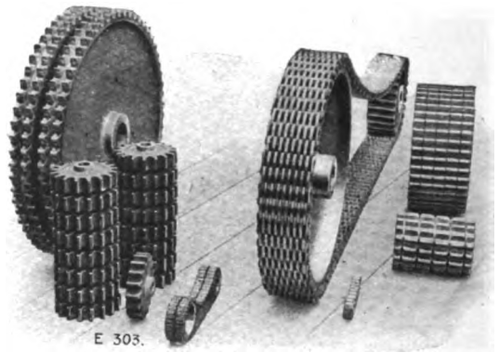


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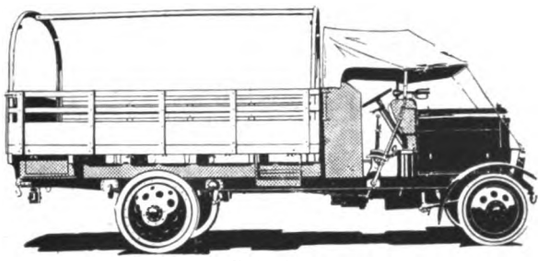

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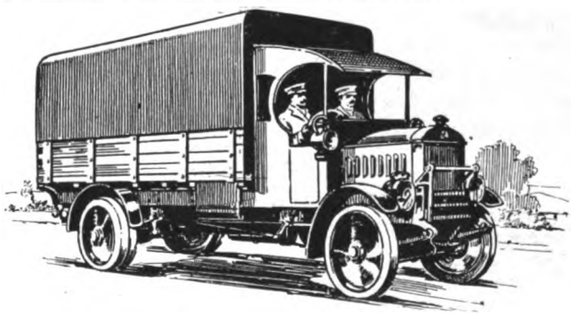

**ZENITH CARBURETTER CO. LTD.,** 40-42, Newman Street, Oxford Street, LONDON, W.1.


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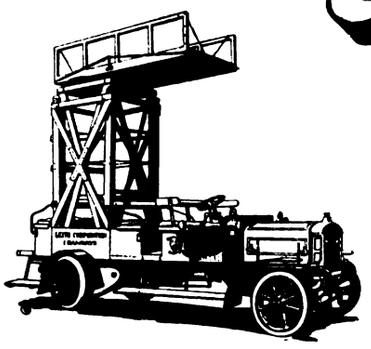
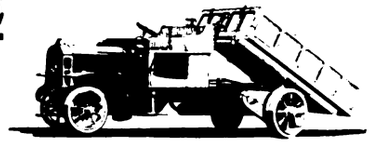
# Halley



## NOW ON WAR SERVICE

BUT AFTER THE WAR
AT YOUR SERVICE



THE ABNORMAL USAGE UNDER WAR CONDITIONS HAS PROVIDED EXPERIENCE NO OTHER SERVICE COULD HAVE GIVEN, AND WHEN THE MANUFACTURE OF PEACE-TIME VEHICLES IS RESUMED OUR PRODUCTS WILL CONTAIN MANY VALUABLE IMPROVEMENTS ON PRE-WAR MODELS, BASED ON THE EXPERIENCE GAINED

**HALLEY'S INDUSTRIAL MOTORS LTD.**

YOKER——GLASGOW

# When you want High Quality

High Speed and Carbon
**Twist Drills**
**Centre Drills**
**Reamers** - Taper
" Parallel
" Expanding

**Milling and Facing Cutters**
**Hack Saws**
**Slitting Saws**
**Band Saws** (Wood or Metal)

Bright Mild Steels, all sections; Tool Steel; Stocks and Dies; Taps and Wrenches; and every other requirement for the Tramway, Motor ——— and Engineering Industries ———

*Write or 'phone to*

**Hays, Hunter & Standen Ltd.**

**110, Cannon Street, London, E.C.4**

'Phone: City 3456-7.

73, Lichfield St., Wolverhampton. 'Phone: 630 Wolverhampton.

Sole Sales Representatives for the Celebrated "FASTNUT" WASHERS. Over Two Million used annually by the L.G.O. Co. Write for free samples.

# DOCKERS' SUPERFINE PAINTS

and

# EXTRA DURABLE VARNISHES

for

**TRAMCARS AND OMNIBUSES.**

# DOCKERS' 'HERMATOR' PAINTS AND ENAMELS

for

**POLES & POWER STATIONS.**

CATALOGUES AND PATTERN BOOKS FREE ON APPLICATION.

**DOCKER BROTHERS Ltd.,**
170 Bishopsgate, LONDON, E.C.,
And BIRMINGHAM.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# ROLLING STOCK SPECIALITIES.

BRITAIN
EXPECTS
BRITISH
BUYERS
TO BUY
BRITISH
GOODS

# OUR RATTAN

(NATURAL, GLAZE, DULL FINISH, OR COLOURED)

in twill, straight, or fancy weaves,
canvas backed or unbacked, is

**BRITISH MADE THROUGHOUT**

from the splitting of the cane to the finished article.

We hold **LARGE STOCKS OF RAW MATERIALS** and can

GUARANTEE PROMPT DELIVERIES.

*Particulars of other* **BRITISH SPECIALITIES** *upon application.*

**THE GENERAL SEATING COMPANY LTD.**
**13 CITY ROAD, LONDON, E.C.**


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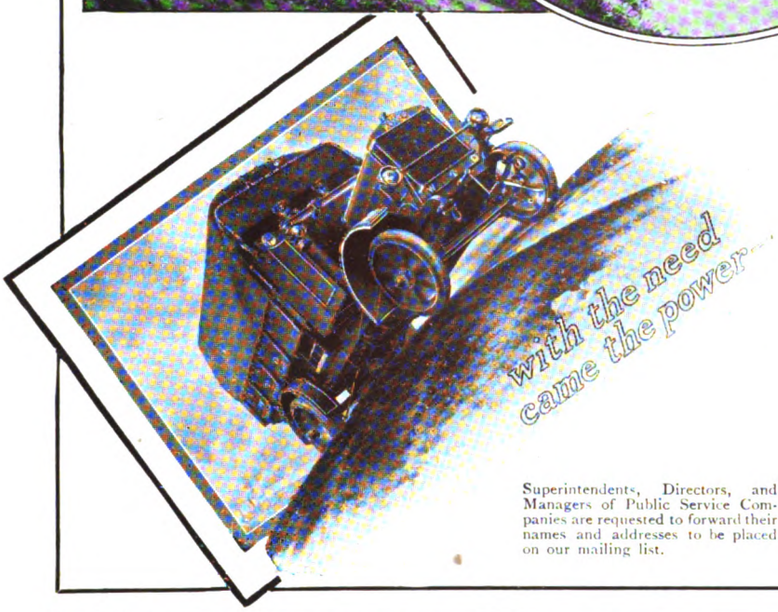
*Tear out this Advt.* KARRIER *and post it*




As you are interested in Commercial Vehicle Efficiency, you should certainly read this folder—"With the Need came the Power."

*It contains the opinions of independent technical experts on a subject of real importance to everybody who owns, uses or drives a petrol motor vehicle.*

**Let us send you a copy and our subsequent publications as we issue them.**

*Write your name and address across this advt. and post it to us—or a card will do:*

CLAYTON & CO. Huddersfield, Ltd.

Superintendents, Directors, and Managers of Public Service Companies are requested to forward their names and addresses to be placed on our mailing list.

# KARRIER

**SUPER-QUALITY MOTOR LORRIES**

KARRIER WORKS, HUDDERSFIELD, ENGLAND.

## The Shortage of Skilled Drivers

If you engage an inexperienced driver to run your lorry it is not improbable that he will one day throw in his clutch with all the vigour his inexperience prompts—strain the whole of your chassis—and do damage in your gear box that will take days to repair.

Make it impossible for him to do this by having the clutch lined with Ferodo fabric. It will then engage sweetly however violently applied—transmit maximum power from engine to back axle—never slip or seize. Ferodo fabric lasts much longer than leather or any imitations of Ferodo fabric, and will not burn out. It gives infinitely superior service at less cost.

*List from*

**The Herbert Frood Co. Ltd.**

**Works: Chapel-en-le-Frith**

*Contractors to the War Office and Admiralty, London General Omnibus Company, and Underground Electric Railways of London and Paris.*

**Depots at London, Birmingham, Belfast, Bristol, Cardiff, Edinburgh, Glasgow, Liverpool, Manchester, and Newcastle.**

FERODO

Friction Surfaces.

# THE AUTOBUS

## IN THE TRAMWAY WORLD.

**Motor Traffic Section.**

**When "The Tramway and Railway World" was founded in 1892, motor traction was, of course, scarcely dreamt of, but the avowed object of the paper was to encourage all new methods that gave promise of usefulness.**

**In pursuance of that policy the progress of motor traction received early attention. Commenting on the historic motor parade to Brighton in 1896, "The Tramway and Railway World" predicted that**

> **"It would give a prodigious impulse to transport both by road and rail."**

**Within a decade this prophecy was abundantly fulfilled and so much space had been devoted to the new industry that in 1906 a special**

### MOTOR TRAFFIC SECTION

**was added. Every illustrated issue thus contains a section devoted especially to motor cars for Public Service, and includes articles on current topics, illustrated descriptions of new types of vehicles and accessories, and the latest news.**

**Public Service Motor Cars.**

**The importance of this section will be gathered from the fact that an increasing number of the leading municipal authorities, railway and transport companies, now own and operate large fleets of motor vehicles, including omnibuses, chars-a-bancs, motor lorries for the transport of goods, parcel delivery vans, tower wagons, motor street sweepers, and a variety of other types.**

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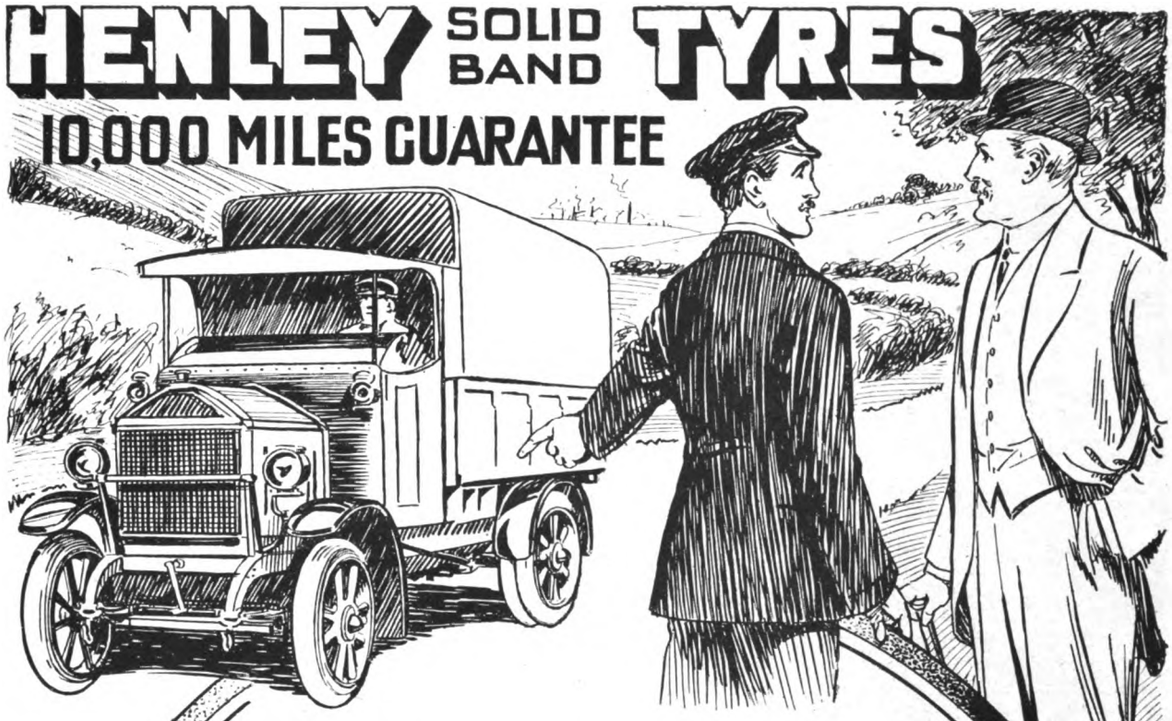
# HENLEY SOLID BAND TYRES

## 10,000 MILES GUARANTEE



## Still good for another few thousand

and they have already considerably exceeded the guarantee by a substantial mileage.

It gives a commercial car owner pleasure even to check his tyre bill when he sees that his tyres are giving him long mileage in return for their cost.

Possibly there are cheaper tyres than "Henley's"—cheaper in initial cost, but the value of a tyre can only be judged by its mileage and dependable service. These are outstanding features of Henley Tyres, and proof of their popularity is to be found in the steadily increasing number used on commercial cars in all parts of the world.

Write for Quotations.

**W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.**

**Tyre Dept.—18, New Union Street, Moorfields, London, E.C.2**

'Phone: No. 3886 London Wall. 'Grams: "Hetewocol, Ave, London."

# HENLEY
## SOLID BAND TYRES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## Tyres and Transport. No. 2.

**Railway Traffic.**—War has made great demands on Britain's railways and, with goods and passenger services necessarily curtailed, every moment saved in railway transport is of tremendous value to-day. There is no greater time-saver in the Transport World than the modern Motor Vehicle, and if you would keep time with the progressive houses of to-day, you cannot afford to ignore this highly-efficient means of transit. And never neglect the tyre question—give your Motor Vehicle tyres that will increase its efficiency—sound, honest, British-made Tyres, such as "Clinchers."

**The Second of a Series** *of Advertisements in which we endeavour to illustrate some of the phases of the transport industry in which a vital part is played by tyres in general—and Clincher tyres in particular.*

North British
# CLINCHER
Pneumatic
and SOLID BAND TYRES

*The North British Rubber Co., Ltd., Castle Mills, Edinburgh, London, Glasgow, Belfast, Bristol, etc.*


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# COMMER CARS

*Commercial Cars, Ltd, Luton.*



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# FODEN

## STEAM WAGONS

. . FOR . .

## PUBLIC SERVICE

A "FODEN" FLEET ON WAR SERVICE

UNSURPASSED FOR

*Low Running Costs*

. . AND . .

*Reliability*

FODENS, LIMITED Elworth Works, SANDBACH CHESHIRE


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# Self-trust

## is the first secret of success

and because we have always known what our Tyres were capable of doing we could fully recommend them

# Wood-Milne

## British Made

# Solid Tyres

have the confidence or "Self-Trust" of their makers, who exact the HIGHEST STANDARD OF EFFICIENCY

Dear Sirs,—We are pleased to inform you of the good record of your tyres fitted to one of our steam waggons, having covered more miles than any make we have ever used. The rear tyre did 10,000 miles, and the front tyres are still running, and have already done 20,000.

*JOSEPH HANSON & SON*
*Motor Haulage Contractors, Longwood*

*WRITE FOR PRICE LIST*

**WOOD-MILNE, LTD.**

21, Albion Street, Gaythorn, MANCHESTER

*Telegrams* "Wudmiln, Manchester" — *Telephone* 8774 City (3 Lines)

PRESTON LONDON BRISTOL LEEDS
BELFAST BIRMINGHAM GLASGOW DUBLIN

Wood-Milne Wood-Milne


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THE
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&
PRINTING Co.,
LTD.

52-58 TABERNACLE STREET, LONDON, E.C.

Telegrams: "Belpunch, London."
Telephone: 7531 Central.

PUNCHES
FOR
OMNIBUSES—TRAMWAYS—RAILWAYS

TICKETS

OMNIBUSES—TRAMWAYS—RAILWAYS

Established 1876.

Enquiries addressed to the SECRETARY, will receive prompt attention.

TUDOR
ACCUMULATORS
FOR ELECTRIC VEHICLES.

ELECTRIC OMNIBUS.—BRIGHTON AND HOVE.

About 16 Electric Omnibuses have been in regular service for the past six years, and TUDOR Accumulators have been employed exclusively.

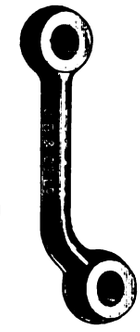
THE TUDOR ACCUMULATOR Co., Ltd.
3, Central Buildings, Westminster, London, S.W.
Works: DUKINFIELD, near MANCHESTER.

TELEPHONE: 228, WEST BROMWICH, 2 LINES.

TELEGRAMS: BROCKHOUSE, WEST BROMWICH.

J. BROCKHOUSE & CO. LTD.
West Bromwich,
ENGLAND.

MANUFACTURERS OF
SPRINGS,
FORGINGS,
STAMPINGS,
PRESSED WORK,
BOLTS, Etc.
FOR EVERY DESCRIPTION OF
ROAD VEHICLES.



YOUR ENQUIRIES SOLICITED.

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# J. W. COURTENAY, Ltd.,

## Tramway and Omnibus Advertising Contractors.

**Offices:**

**LONDON:** *Amberley House, Norfolk Street, W.C.*
**EDINBURGH:** *34, St. Andrew Square.*
**LIVERPOOL:** *Princes Buildings, 81, Dale Street.*
**BIRMINGHAM:** *147, Corporation Street.*
**LEEDS:** *Standard Assurance Buildings, City Square.*
**NEWCASTLE-on-TYNE:** *50, Grey Street.*

**HIGHEST RENTS PAID** for sole rights of advertising on any system of Tramways or Omnibuses.

**All Advertisements kept in perfect condition by an efficient staff of workmen.**

**Sole Contractors for**

*Liverpool Corporation Tramways.*
*Edinburgh & District Tramways Company, Ltd.*
*Belfast City Tramways.*
*Leeds City Tramways.*
*Birmingham Corporation Tramways.*
*Leicester Corporation Tramways.*
*Nottingham Corporation Tramways.*
*Portsdown & Horndean Light Railway Co.*
*Wakefield & District Light Railway.*
*Londonderry Tramways Company.*
*Calcutta Tramways Co., Ltd.*
*Cawnpore Electric Tramways.*
*Delhi Electric Tramways.*
*Mandalay Electric Tramways.*
*Dover Corporation Tramways.*
*Newcastle-on-Tyne Corporation Tramways.*
*Cork Electric Tramways and Lighting Co., Ltd.*
*Isle of Thanet Electric Tramways Company Ltd.*
*Keighley Corporation Tramways.*
*Keighley Corporation Motor 'Buses.*
*Burton-on-Trent Corporation Tramways.*
*Scarborough Electric Tramways Co., Ltd.*
*Aberdeen Suburban Tramways Co.*
*Paisley & District Tramways Co.*
*Hastings & District Electric Tramways Co., Ltd.*
*Gosport and Fareham Tramways Co.*
*Doncaster Corporation Tramways.*
*Cardiff Corporation Tramways.*
*Plymouth Tramways.*
*Gloucester Corporation Light Railways.*
*Ilkeston Corporation Tramways.*
*Stockport Corporation Tramways.*
*Accrington Corporation Tramways.*
*Ilford Council Tramways.*
*Aberdeen Corporation Tramways.*
*Bradford Corporation Tramways.*
*Southampton Corporation Tramways.*
*Halifax Corporation Tramways.*
*Perth Corporation Tramways.*
*Malta Tramways Company.*

J. W. COURTENAY, Ltd., are sole agents in the United Kingdom for advertising rights on the tramcars in most of the towns in the following countries, viz.:—

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**MANUFACTURERS OF**

**Transparent Coloured Glass and Opal Glass**

**ADVERTISING TABLETS.**


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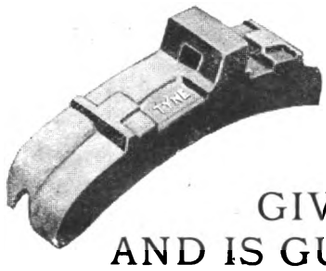
FOR BRAKE SHOES SPECIFY



"TYNE METAL"

IT RESISTS HEAVY WEAR
GIVES GOOD BRAKING EFFECT
AND IS GUARANTEED CHEAPEST PER CAR MILE

TYNE METAL CO. Ltd.

HEXHAM-on-TYNE

TRAMWAY SUPPLIES, LTD.

TRAMWAY ENGINEERS,

Sole Manufacturers of

TURNER'S PATENT AUTOMATIC POINT CONTROLLERS.

OVERHEAD LINE MATERIAL and SUPPLIES.

160, Woodhouse Lane, Leeds.

Telegrams: "Controllers, Leeds." Telephone: 3488, Leeds.

DURING THE PRESENT SHORTAGE OF LABOUR

. . USE THE . .

RAIL CLEANERS

NOW IN OPERATION ON ALL THE PRINCIPAL
TRAMWAYS THROUGHOUT THE WORLD

GEO. W. GREEN & CO., (FELTHAM) LTD.

Q-FEL WORKS, FELTHAM, MIDDLESEX.

Tel.: "CUFEL, FELTHAM."
Telephone No. FELTHAM 14.

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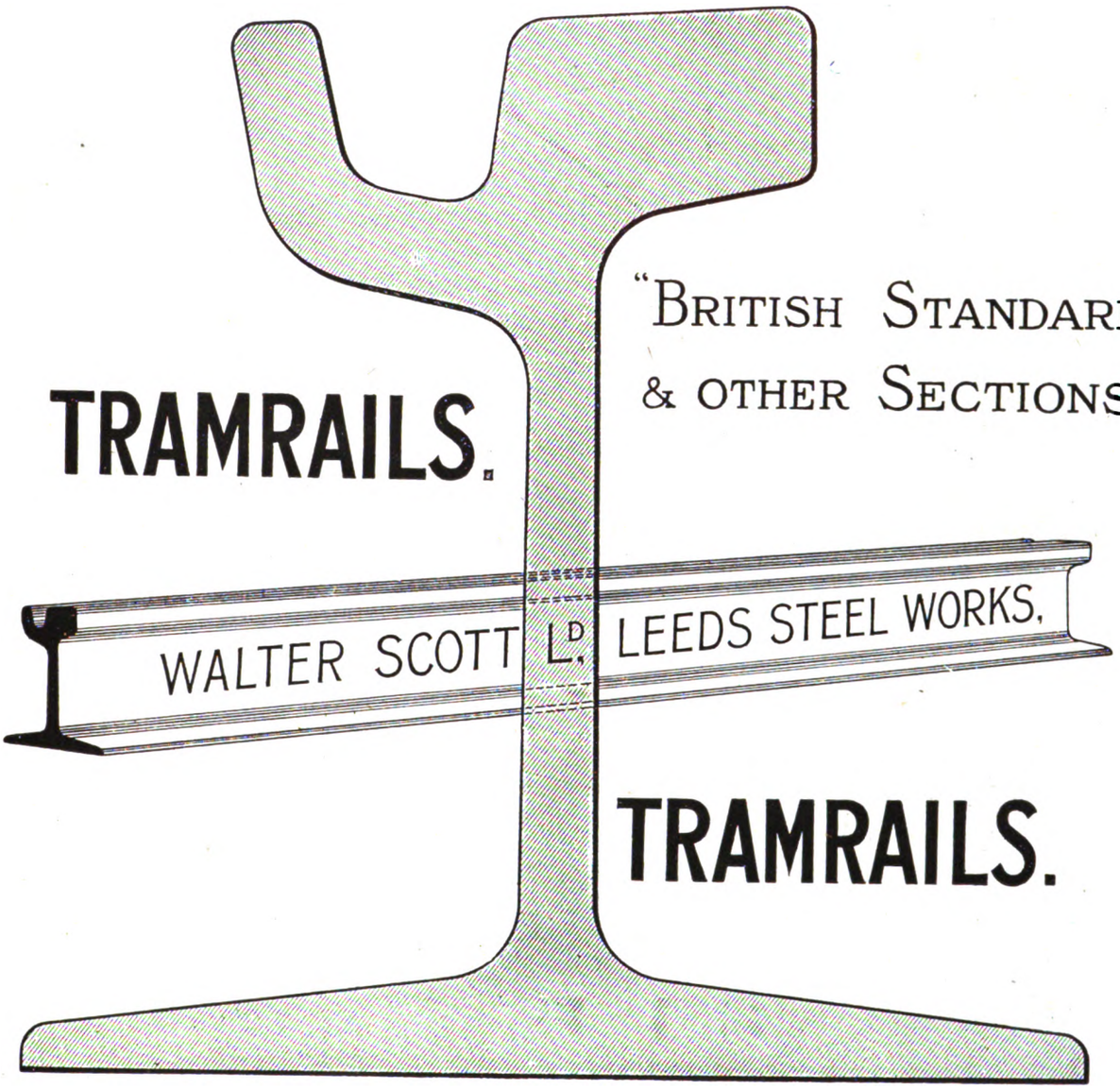
# WALTER SCOTT LTD.

## THE LEEDS STEEL WORKS,

Telegrams: LEEDS. "Bessemer, Leeds."

Manufacturers of

ROLLED STEEL JOISTS, CHANNELS, ETC.




Also Makers of

MILD STEEL BLOOMS, BILLETS, SLABS, FLATS, TINBARS & ROUNDS.

Riveted Plate and Compound Girders, Stanchions, &c.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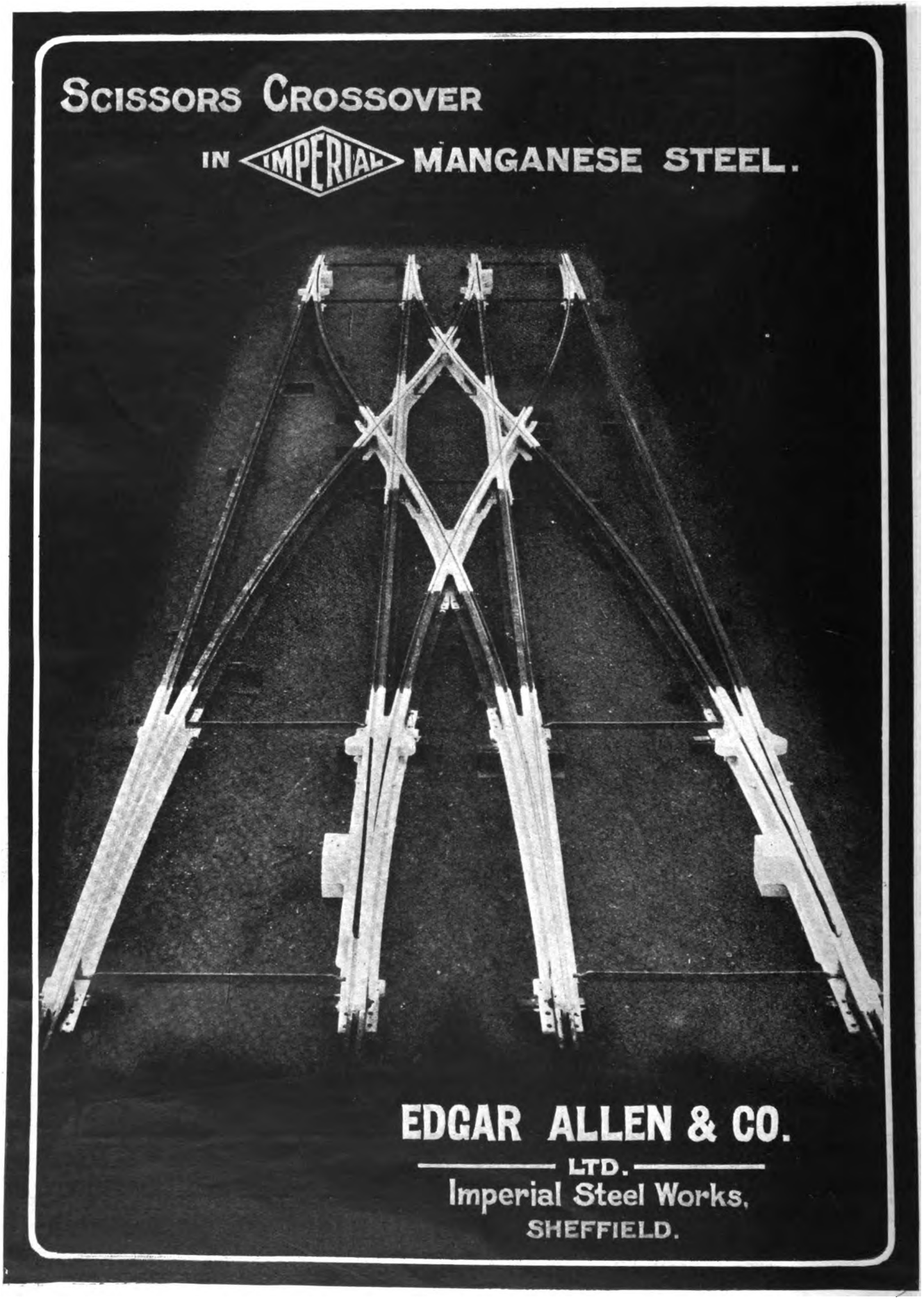


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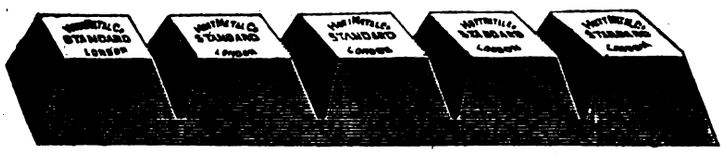
# HOYT BEARING METALS.



HOYT ANTI-FRICTION METALS GIVE

## MAXIMUM MILEAGE.

FULLEST PARTICULARS, PRICES, SAMPLES, COMPARISONS AND MOST CAREFUL CONSIDERATION ON REQUEST.

**ORDER A TRIAL LOT,**

**AND LET PAYMENT DEPEND UPON YOUR SATISFACTION.**

## THE HOYT METAL CO., LTD.,

(WORKS : MILLWALL, E.) 26, BILLITER STREET, LONDON, E.C.3.

## "GROVER SPRING WASHER" NUT-LOCK

**BEWARE OF ALL CHEAP IMITATIONS**
**They are like the original in appearance only.**

FOR . . .
**FISH BOLTS** (Iron or Steel)
**ROLLING STOCK,**
**SIGNAL WORK, &**
**GENERAL PURPOSES,**
**ELECTRICAL WORK, &c.**

**SALES OVER 135,000,000.**
Made in all sizes from $\frac{3}{16}$ in. to 4 inches, and in Millimetres.

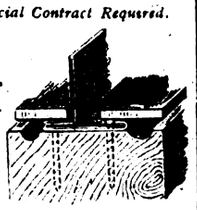
## SIMPLEX LEAD GLAZING

**FOR ROOFS, SKYLIGHTS, & HORTICULTURAL WORK.**
*No Special Contract Required.*

**NO ZINC, IRON, OR PUTTY USED.**

*ANY QUANTITY SUPPLIED.*

Millions of superficial feet in use on thousands of Structures.



*Write for full Illustrations, Testimonials, and Particulars (sent post free).*

**GROVER & Co. Ltd.** Britannia Engineering Works, Carpenters Rd., Stratford, London, E. Telephone

Telegraphic Address: "ADOPTED, STRAT LONDON." STRATFORD 984-985.

## Are You Satisfied With Your Ticket Service ?

**Telegrams: "TICKETS, GLASGOW."**

If you ask that question of the managers of the largest tramway undertakings, both at home and abroad, the answer will be:

"Yes, we use Glasgow Tickets."

May we send you some specimens? We produce tickets in any style, in any quantity, and print in any language.

Whenever you want tickets, either paper or pulp, we shall be pleased to quote you.

Freedom from ticket worry will be assured if you send your orders to

**GLASGOW NUMERICAL TICKET & CHECKBOOK PRINTING CO.**
**31, FINNIESTON ST. GLASGOW**


Printed for the Proprietors by Chorley & Pickersgill, Ltd., The Electric Press, Leeds, and Published by the Proprietors at their Offices at Amberley House, Norfolk Street, London, W.C., December 13, 1917.

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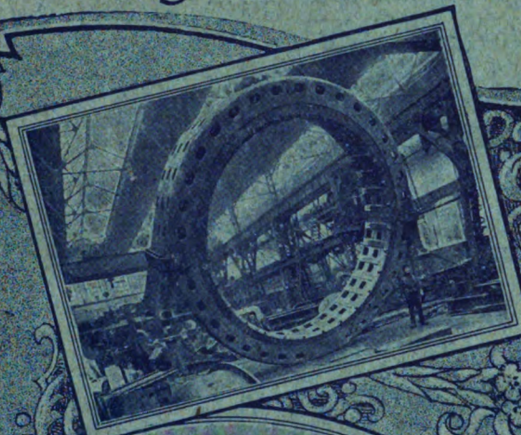
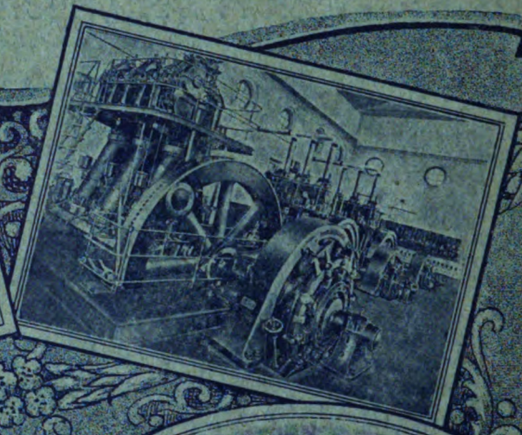
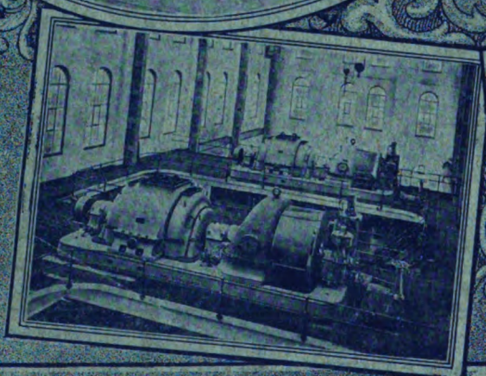
# DICK, KERR & Co. LIMITED

## Engineers and Contractors



MANUFACTURERS OF:—A.C. & D.C. Generators, Motors, Rotary Converters, Steam Turbines, Electric Lamps, Electric Traction Equipments, Diesel Oil Engines, Tramcar Bodies, Locos, &c.,
CONTRACTORS FOR:—The complete construction and Electrification of Railways & Tramways, the equipment of Electric Light & Power Stations, and the construction of Sewage Works & Reservoirs.

Head Office: ABCHURCH YARD, CANNON ST, LONDON, ENGLAND
Branches: Manchester, Newcastle, Tokyo, Sydney, Johannesburg, Buenos Aires, Rio de Janeiro & Milan.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